Inquiry on Federal Water Policy

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THE ECONOMICS OF WATER EXPORT POLICY

by
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with the assistance of
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Canada

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Research Paper # 7

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THE INQUIRY ON FEDERAL WATER POLICY

The Inquiry on Federal Water Policy was appointed by the federal Minister of the Environment in January of 1984 under the authority of the Canada Water Act. The members were Peter H. Pearse, chairman; Françoise Bertrand, member; and James W. MacLaren, member. The Inquiry was required by its terms of reference to review matters of water policy and management within federal jurisdiction and to make recommendations.

This document is one of a series of research papers commissioned by the Inquiry to advance its investigation. The views and conclusions expressed in the research papers are those of the authors. Copies of research papers and information on the series may be obtained by writing to the Enquiry Centre, Environment Canada, Ottawa, Ontario K1A 0H3.

Frank Quinn
Director of Research

Abstract

Economic aspects of the water export issue are addressed, as are means for economic analysis to contribute to Canadian policy on this subject. Federal and provincial governments are encouraged to prepare a policy which includes what bodies should be formed, what information should be collected and what procedures set out.

Résumé

Les aspects économiques de la question des exportations d'eau sont abordés dans ce rapport de même que différents outils d'analyse économique pouvant contribuer à l'adoption d'une politique canadienne sur ce sujet. Les gouvernements fédéral et provinciaux sont encouragés à élaborer une politique qui identifierait quels organismes seraient requis, quelle information devrait être collectée et quelles procédures devraient être établies.

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CHAPTER I. INTRODUCTION

A. The Terms of Reference

This is a report on the economics of water exports. Its main theme is that economic modes of thought have much to contribute to the drafting of Canadian policy on this subject, and its chapters make suggestions about what the message of such a policy should be. What is important is that governments should prepare themselves now. Otherwise proposals to transfer water from Canadian rivers and lakes to the United States will find us with our facts unmarshalled and our points of view unclarified. We are then likely to respond with our usual federal-provincial confusion providing a background for diverse trumpetings about the national interest, provincial rights, the sanctity of water, and government interference. If governments will begin to formulate a policy now, they can avoid this rhetorical stage and with tested principles and procedures look hard and analytically at the kind of export proposal that may suddenly be waved before them.

How should they prepare themselves? We feel that an economic approach to policy formulation, apart from its intrinsic merits, has the additional merit of indicating what bodies should be formed, what information collected and what procedures set out. The danger here is that we will mistake action for preparation. In our work on this study we have heard from well-informed experts almost too quick to warn of a crisis in our water affairs, but less helpful where concrete advice is required. For example, after a recent Canadian-American conference convened by the U.S. Council on

Foreign Relations, the author of the proceedings wrote:

> "Fresh water, long considered inexhaustible and hence a "free good", now begins to appear as a -- perhaps the -- major long-range resource issue on the continent. Although the quality of both surface water and ground water is already of concern in some places, the issue of water quantity is further down the road in terms of impact and, for that reason, suggests a different kind of bilateral attention than acid rain now receives. If unaddressed, rising demand over the next decades, especially by Americans, can cause problems of unprecedented seriousness since water is clearly the most precious of all continental resources. Complex and expensive schemes for water diversion have been and will be proposed. Long-term planning is essential, taking into account such diverse factors as climate change, world population pressures, and food needs. It would be desirable for the two governments to initiate now a systematic and coordinated review of impending or future changes and problems so as to have early warning and the capacity for whatever joint or separate action may be appropriate or possible" (Council on Foreign Relations, 1984:8).

The warning here is timely, but is the specific advice correct? Should Canada start by a "coordinated review" of impending problems even before it has examined its own needs and resources; even before it has seized the opportunity to analyse for itself what types of actions would harm, and what would help the contribution that water can make to Canadian well-being? This report is intended to take us a few steps in the direction of forming a water-export policy by exploring the advantages and difficulties inherent in an economic approach, and their implications in terms of governments, agencies and institutions. As our objectives were set out in our terms of reference, the study was to:

1. identify the varieties of meanings of water export and their significance (e.g. tanker export, diversion from international watercourses, hydroelectric export, etc.);

2. explore the alternative policy positions that Canada might adopt, ranging from prohibition through regulation to free trade, and the economic and political implications of each;

3. develop broad benefit/cost calculations which assess various economic, environmental and political factors, and include considerations of flexibility, reversibility, timing and

scale;

4. develop a framework in which governmental machinery at different levels might be brought to bear on the subject of water export;

5. recommend appropriate measures (research, data, planning, policy) for the federal government to address the water export issue more effectively in future.

B. Contents

The next two chapters of this study present some important background information on water exports, to provide a context for the subsequent chapters on policies for and economic analysis of export proposals. Chapter II examines physical factors that affect water export costs, environmental impacts of water exports, and important aspects of international law and Canadian constitutional law that could affect management of water exports. Chapter II also discusses potential American demand for Canada's water and briefly discusses Canadian water supply.

Chapter III presents some historical information relevant to Canadian water exports. Two existing exports are described, and a number of water export proposals -- including two active proposals -- are outlined. A brief survey of current federal policies for exports of a number of other Canadian natural resources is presented, followed by a discussion of current Canadian water export policies, which concludes Chapter III.

In Chapter IV, the range of possible export policies is described, and the benefits of a flexible, adaptable -- but rigorous -- approach to dealing with export proposals are argued. The chapter then proposes a new approach to water export policy -- one that is based upon economic analysis of the benefits and costs that each export project would involve for Canada.

Chapter V examines in detail the benefits and costs of exports, and discusses the issues of valuation, uncertainty and commensurability as they relate to economic analyses of water export projects. An illustrative calculation is presented in Chapter V to suggest how the proposed economic approach might be applied in practice.

Chapter VI focusses on possible administrative arrangements for water exports. A number of existing examples of inter govern-

mental arrangements -- federal-provincial, interprovincial and international -- are described, and a number of criteria for establishing an administrative arrangement are presented. Finally, the chapter proposes one possible arrangement of this nature.

Chapter VII, which presents some key findings and recommendations, concludes this study.

C. Acknowledgements

The help that the author and his associates have obtained from experts is suggested in part at least by the bibliography. In addition, they wish to thank Professor Bruce Wilkinson of the University of Alberta, Professor Andrew Thompson of the University of British Columbia, Professor Kent Olson of Oklahoma State University, and Professor Dixon Thompson of the University of Calgary. Dr. Frank Quinn, Director of Research for the Inquiry, an expert in his own right, has helped us to obtain valuable material, and the members of the Inquiry have been helpful. Finally, we want to thank Ms. Audrey Moroz and Ms. Jerry Pladsen of the Westwater Research Centre of the University of British Columbia for their enthusiastic, rapid and accurate transcribing of the manuscript.

CHAPTER II. SOME BASIC CONSIDERATIONS

A large number of factors go to determine whether Canada can, or should, export water. This chapter provides some background information on types of water exports, physical factors affecting costs of water exports, legislative jurisdiction over water exports, demand for water in the United States, and the availability of Canadian water for export.

A. Water Export and its Physical Costs

Conceptually, the term "water export" can be applied to a wide range of activities. Perhaps the most common image evoked by the term is the diversion of water from rivers within Canada through canals or pipelines, or both, to the United States. This type of water export project typically involves moving large volumes of water over long distances, with correspondingly large expenditures. A second type of export is the movement of water by large tankers from Canada to another country. This type would involve much smaller volumes of water and, likely, lower costs as well.

While the above clearly constitute water exports, there are a number of other activities that border on being exports, but are not obviously so. For example, some rivers flowing between Canada and the United States are subject to water apportionment understandings between the two nations. A change in the apportionment that allocated more water to the United States and less to Canada would amount to a water export. As with any physical diversion, Canada has less water to use, the United States has more.

Other activities that bear mention are what may be termed water-based exports. Several hydro-electricity developments in Canada rely on American markets for the power they generate. By importing hydro-electricity from Canada, the United States is placed in the same position as it would be if it had imported a Canadian river and its generating site (Lucas and Saunders, 1983). A second kind of water-based export is of goods that are produced with Canadian water. An example could be agricultural produce from irrigated lands. Indeed, Rogers (1984:56) goes so far as to suggest that international trade in foodgrains constitutes a form of water transfer -- a line of reasoning that could be applied to other agricultural crops as well. Increased exports of industrial products, from beer to aluminum, that require water or water power in their manufacture could also be included in this exportation category. However, while such water-based activities may scientifically be argued to lead to water exports, they will not be so considered here. It would appear to be more productive instead to view them as domestic economic activities that significantly affect the supply of, and the demand for, water. These activities represent alternatives to water exports, albeit only to a limited extent, and therefore should be included in an economic analysis for a water export proposal.

In this study, the term water exports will be taken to mean physical diversions of water from Canadian drainages to a foreign country. For purposes of illustration, this study refers primarily to hypothetical large-scale (large volume) transfers from a Canadian river, through canals, across the border to an American river or basin. However, the analysis is intended to be sufficiently flexible to apply equally well to smaller-scale transfers as well.

What physical factors are most important in any consideration of the success (or costliness) of any proposal to export water? Perhaps the most obvious factor is the distance between the point of water withdrawal and the foreign receiving basin or point of use. The greater the distance of the diversion, the higher the canal and infrastructure cost will be, other things being equal. Closely related is the pattern of topography and water drainages along the route of the diversion. In some cases, it may be possible to divert water along existing basins with only short canals in between, which may prove less costly than having to construct a canal to cover the whole distance.

Watershed storage capacity is also a very important physical factor. Because of the seasonal variability of natural waterflow, a number of dams and impoundments would be a necessary component of any large-scale water transfer, to ensure that the flow of exported water was reliably available when needed. Elevation is similarly important. If water were to be exported to a basin at a higher elevation, or between two low basins across an area of higher elevation, additional costs would be faced in lifting the water to the higher level. These pumping costs would be affected not only by the total difference in elevation, but also by the topography along the route. Thus transferring water across hilly or mountainous terrain would likely incur greater pumping costs than moving water a comparable distance across a plain. It is worth noting here that some of the proposals made for water exports from Canada (see Chapter III) suggested that the energy required to lift the water would be provided by hydro-electric generators in the diversions' own dams.

A final physical factor that will affect the cost of exports is the quantity of water to be exported. The choice or design of infrastructure will be dictated largely by this factor. The extent to which economies of scale can be obtained is uncertain. While there are real economies when the scale of very small projects is increased, it must be recognized that there is a definite upper limit. One study cited by Howe and Easter, "indicates that scale economies in canal construction are virtually exhausted at a capacity of 7,000 cfs [cubic feet per second, or about 200 cubic metres per second] . . . " (1971: 61).[1] Clearly, the principle of diminishing returns to increases in scale must be watched for in economic analyses of water export proposals: "mega projects" are probably the worst kind of water export project.

In addition to these factors, we should note that there are factors than can affect the construction cost of any project. For example it is probably wastefully costly to construct a water export canal in distinct phases spread over a number of years (unless the project had other purposes such as water supply for irrigation at intermediate points). If it were intended solely for carrying water to export its construction would cost least if it were continuous, with its numerous components (dams, canals, etc.) begun concurrently. This is chiefly because, most costs of export projects being incurred at the outset, the interest expense of any extension of the construction phase accumulates into prohibitive carrying costs later on. While the weight of this effect depends of course on the rate of interest to be borne and the capital-intensity of the particular project, it is likely that these would

give the promoters an incentive to build all the various projects, dams, canals and so forth at the same time.

B. Environmental Impacts of Water Exports

Large-scale transfers of water out of Canadian streams would create large-scale environmental impacts. These can be categorized into two types: the effects of project construction; and the effects of the actual water diversion.

1. Impacts of Project Construction

During their construction stage water export projects would have effects on both aquatic and terrestrial ecosystems. Some of these arise from the impoundment, temporary diversion and disturbance of rivers and lakes. These could damage or destroy fish habitats, and further harm the fish populations by siltation and turbidity. The construction activity could also harm wildlife and flora around the sites as quarries, roads and dumps scar the landscape, especially those valleys which provide the key winter habitats for big game and smaller animals.

Building canals could have comparable effects. There would be habitat lost to physical destruction during construction (and, on a continuing basis thereafter) because of work along the route. The building activities could cut off some species such as moose, deer or cariboo from portions of their normal ranges, if they acted as either a physical or a psychological barrier.

Nor would such effects be limited to fish and wildlife. Construction work on canals could interfere with farmers' access to their lands, raising their costs or demanding more time. (The outright permanent loss of agricultural land, to be mentioned later, is additional to this more temporary effect.) And there are other social costs of construction -- mainly those associated with the temporary nature of the influx of construction workers to "boom" communities along the canal route. These social costs would be similar in nature to those Canada has already experienced during construction of railways, pipelines and other linear facilities.[2]

2. Impacts of Water Diversion

Once construction has been completed and water diversions initiated, the benefits begin. But permanent environmental impacts also begin. Four main categories of impacts have been identified:

levels (flooding); streamflow reduction; drying of marshes and lakes; and risks of transferring harmful exotic species into Canadian drainages.

The chief levels effect would occur when the reservoirs were filled after the dams were built. As previously mentioned, valley bottoms typically are important areas for wildlife habitat: filling a reservoir would ruin some of this key habitat. Flooding also precludes future use of an area for forestry and agriculture -- the proposed B.C. Hydro development at Site C on the Peace River is an example. However, it is to be noted that stream diversion will reduce some levels and so mitigate flood damage there.

The increased amplitude of water-level changes would be most noticeable in the systems' newly created lakes. Although man-made reservoirs are often touted as having recreational benefits, these depend on water levels remaining relatively constant. Taylor (1967:24) points out that reservoirs "are constructed to move water from one time period to another". Most reservoirs -- especially those associated with large-scale water diversions -- would have large fluctuations in their water levels, as the reservoir or lake would be drawn down during dry periods of low natural flows, and recharged during high-flow periods. For example, according to Bocking (1972:62), the level of the Mica Reservoir fluctuates up to 45 metres. These fluctuations may cause shoreline erosion and in any case they obviously reduce the utility of the reservoir or lake for recreation and as habitat for fisheries and wildlife.

Streamflows would be affected in both quality and quantity. Flows downstream would be reduced when impoundments were being filled, not only initially when the dam was first built, but later each time the impoundment was replenished after a period of drawdown. Reduced streamflows may have a number of effects. Oxygen levels usually drop if turbulence is reduced, probably with harmful consequences for aquatic species; streambank erosion may increase near the impoundment; spawning beds for fish could be damaged by increased scouring; and estuarine salinity may increase (Bryan, 1973). Other possible impacts listed by Ortolano (1979) include changed rate of groundwater recharge; altered water temperature and quality; and modified sediment transport characteristics. Two important water quality effects of reduced streamflow are reduced pollution assimilation capacity and reduced power generation capability (Howe, 1979).

An effect described by Bryan (1973) is the drying up of marshes and lakes below the dams and diversions. This occurs due to a combination of reduced average streamflow as well as reduced

peak streamflow (during the spring freshet, for example). Perhaps the best-known example of this effect may be found in the Peace-Athabasca delta, where elimination of spring floods by the Bennett dam on the Peace River has resulted in large areas of the delta drying up, with consequent effects on populations of fish and fur-bearing species such as muskrats and beaver (Bryan, 1973). These in turn harmed the Indian and Metis populations in the region (Bocking, 1972).

One other environmental effect associated with water transfers is the increased risk of the introduction of a non-native, or exotic, species into northern drainages. A canal between Canada and the U.S. would provide a conduit through which some undesirable plants or animals could move or be transported. This was demonstrated in the early 20th century when lampreys invaded the upper Great Lakes following the opening of the Welland Canal and decimated the commercial fisheries. The changing drainage patterns around the Garrison Dam will, it is argued, have similarly undesired side effects.

3. Environmental Impacts - A Concluding Note

These brief listings suggest that water exports can cause a wide variety of effects. It is almost impossible to say anything definite about their general tendency, for some may be regarded as beneficial and some as harmful. Indeed there is great doubt about how much of any particular impact will occur. As Holling (1978) has said, it is impossible to predict in advance all the environmental effects of a large development project. This impossibility must be kept in view in economic appraisals to offset the deceptive definitiveness of numerical estimates.

For example, mid-century dam construction affected fish migrations and populations in many rivers. Uncertainty reared its head in a number of forms: uncertainty about the actual severity of the impacts on fish; uncertainty in placing a value on those impacts; uncertainty as to whether the impacts should be treated as unavoidable or as susceptible to mitigative measures; uncertain success of any mitigative measures; and so on. The fishery example suggests the difficulties of identifying and quantifying environmental costs of water exports involving putting values both on alternative ecological states and on alternative attempts to preserve them. Both problems, uncertainty and valuation, are discussed in Chapter V.

C. Control and Jurisdiction over Water Exports

There is probably less uncertainty surrounding citizen's and governments' ability to exercise control over water exports. Since no studies addressed specifically to water-export aspects of this subject have been found, the following examination of the subject relies on literature on related themes -- for example, on studies of how the constitutional division of powers affects water management, environmental management, or natural resources management in general. There has been no judicial decision dealing with water exports in particular, so this "analysis" must be limited to suggesting possible or likely arguments for establishing jurisdiction over water exports. The discussion is divided into two parts: ownership of water; and jurisdiction over exports.

1. Private Ownership of Water

Under our traditional or common law, property interests in water are a consequence of ownership of land. While it is common to refer to "ownership of water," the phrase is technically inaccurate, because

> . . . the law has never recognized the ownership of such ["fugitive"] commodities while they remain in their natural state. . . . This is not to say that there can be no legal rights over water . . . in the natural state. Various rights of exploitation of water and its contents accrue to those who own the land underlying or adjacent to the water (Gibson, 1969:73).

These "riparian" rights of water use and exploitation are incident to or run with the riparian land: that land bordering or underlying the watercourse. A person who owns such land can use the adjoining water freely so long as his use does not harm other riparian owners along the stream. This condition tends to limit the amount he can withdraw completely to prevent his transferring water away from his riparian property.

But in the Canadian provinces the simple system of private landowners having riparian rights to adjoining water is rarely in effect today[3]. Instead the provincial governments exercise, more or less, all rights over water within their boundaries. This provincial control is typically based on one of three foundations. In some cases the main basis for governmental control is simply that the provincial Crown is itself the largest holder of "private" riparian rights; in some provinces the government has used its

regulatory powers to restrict private landowners' use of their riparian rights; and the third foundation is that some of the governments have essentially abolished the system of riparian rights and have replaced it with a system of water licences similar to the "appropriative" private water rights in regions of the United States.

The second approach, based on permits to use water, is found in Ontario and the eastern provinces. The third approach in which a government vests in the provincial Crown all property in, and all rights to use, water in the provinces is predominant in the western provinces.

While it is not certain that these three bases are clear enough to deprive every landowner in Canada of all riparian rights to water in all adjoining streams, they do go far enough to justify an assertion that in most situations where it might be proposed to re-apportion or divert water to exports, the "owner" to be dealt with would not be local citizens but the provincial government.

2. Jurisdiction over Water Exports

So much for "ownership" of exportable water. This section deals with power to legislate under our federal constitution. Both federal and provincial governments would have roles.

The Constitution Act contains a number of sections that could establish federal jurisdiction over water exports. First, the combined operation of sections 91(29) and 92(10)(a) grant Parliament jurisdiction over certain classes of works and undertakings that stretch beyond the boundaries of one province, especially shipping lines, railways, canals, telegraphs "and other Works and Undertakings connecting the Province with any other or others of the Provinces, or extending beyond the Limits of the Province, . . ." (section 92.10.(a)).[4] This term "undertaking" has been given a broad legal definition. La Forest describes an undertaking as "not being a physical thing, but an arrangement under which physical things are used" (1973:49). In the provinces' water legislation, according to Beerling (1984:48), "The word "undertaking" is [typically] a reference to a project to develop, transport, distribute or use water or water power. It encompasses any means of storing water or stopping its flow. It covers channelling or changing the flow of water." LaForest (1973:54) suggests that the determination by the courts of whether an undertaking comes under provincial or federal jurisdiction depends on whether the undertaking is "in pith and substance" of a provincial or of an interprovincial or national nature. Some water diversions, and

certainly water export undertakings, would seem to fall into the national or interprovincial category and so to be subject to federal powers.

Other relevant heads also support a claim for federal authority over water exports. Section 91(2) -- "The Regulation of Trade and Commerce" -- is one. Although the general influence of this section has over the past fifty years been circumscribed in a series of judicial interpretations, it remains central to any claim for federal jurisdiction on many subjects. For one thing, it "may help to extend federal legislation once it has been established under another head. . ." (Emond, 1972:669). Furthermore, as will be seen in Chapter III, it has been confirmed as the basis for federal controls over the export of logs and natural gas.

A third heading for federal jurisdiction over water exports can be found in the so-called "Peace, Order and good Government" clause in the pre-amble to section 91 of the Constitution Act, giving Parliament the authority ". . . to make Laws for the Peace, Order, and good Government of Canada, in relation to all Matters not coming within the Classes of Subjects by this Act assigned exclusively to the Legislatures of the Provinces . . ."

In deciding whether legislation justified under this clause is within the federal Parliament's powers, the courts have used as a test whether the real subject of the legislation is beyond provincial interest alone and concerns Canada as a whole or has a national dimension. Recent Supreme Court opinions (1976) tend to confirm a view that water exports might well be treated like aeronautics, radio and atomic energy as being of distinct national concern.[5]

A fourth source of federal power is related to treaty making. Because of the international obligations that would arise as a consequence of large-scale water exports, Canada might wish to enter into a treaty-like agreement with the U.S. using the federal government's power to negotiate and conclude treaties with the United States. While such treaties may be binding on Canada (that is, on the federal government) under international law, their implementation in Canada would have to follow the constitutional division of powers between the federal and provincial levels of government (LaForest, 1973:12).

A fifth pair of powers assigned to the federal government deals with authority over "Navigation and Shipping" (section 91(10) and "Sea Coast and Inland Fisheries" (section 91(12)). These heads may give the federal government a virtual veto power over those

water diversion projects that interfere with navigation, shipping or fisheries. Construction of a dam on a river for example could have such an effect, and it would need approval under the federal Navigable Waters Protection Act or the Fisheries Act or both. These two powers ". . . ensure that the federal government has a substantial lever with which it can ensure a measure of provincial cooperation [in the matter of interbasin water transfers]" (Percy, 1981:7).

Finally, the federal government could have influence over development of a water export project by exercising its spending powers. Funds generated through the broad federal taxation power (section 91(3)) could be used to extend Parliament's influence over subjects not specifically granted it by the Constitution Act. While the status of this power varies from decade to decade, Parliament has successfully used it for post-secondary education, health, regional development, and other "provincial" functions.

Its effectiveness depends on the extent to which Ottawa can attach conditions to its disposal of money and other property. When disposing of public funds, for example, Parliament has used conditional grants to regulate activities where it does not have clear jurisdiction. Today's thinking is however that "Parliament may not directly invade the realm of provincial authority under the guise of its spending power" (Emond, 1972:667). The federal spending power will be less influential where funds for construction and operation of a water export project are raised by the province or privately.

This interpretation of six sources of federal-government jurisdiction suggests that the federal government must always play some roles in setting up or/and approving a water export project. Especially important are its (rather weak) Trade and Commerce powers, its national dimension powers, its foreign-affairs powers, and its spending powers. But any combination of these powers comes up against an even more formidable array of provincial powers. The combination of provincial ownership rights and powers is so comprehensive that, were a very large water transfer project to be entirely within one province, virtually no federal role might be found. Indeed it may be claimed that even in a transfer of water between two provinces (where no disagreement was involved and where both provinces were chiefly depending on their regulatory rights to water mentioned in section C.1 above) any federal involvement would go beyond what the strict satisfaction of federal constitutional responsibilities requires.

Perhaps the most important provincial legislative power is over allocation of water within the provincial boundaries, based in part on the provinces' proprietary interest, and in part on the exclusive powers granted by section 92 of the Constitution Act. The three principle heads are:

92(5) The Management and Sale of Public Lands belonging to the Province and of the Timber and Wood thereon,
(13) Property and Civil Rights in the Province,
(16) Generally all Matters of a merely local or private nature in the Province.

What does "belonging to" the province mean? We have seen that the provincial property interest in water amounts almost to outright ownership. This property right exercised by the legislature, combined with the province's other legislative powers give a province very comprehensive jurisdiction of water resources within their boundaries. It is unclear, however, whether it is comprehensive enough to allow the province to allocate water specifically for export purposes. Since such an allocation could be construed as part of an "extra-provincial" venture or undertaking, it could be argued that doing so specifically for export falls under federal jurisdiction. This argument, however, is wholly conjectural. In a legal test the provinces could likely present a strong case based on their proprietary status and legislative powers in favour of provincial control of water export allocation decisions -- especially in the absence of specific federal water export legislation. At present, any intending water exporter would certainly need to receive an allocation of water from the provincial government, and, without federal legislation to the contrary, that allocation might just be valid for exports as well.

The 1982 natural resources amendment to the Constitution Act (section 92A) confers on the provincial governments legislative authority over ". . . development, conservation and management of sites and facilities in the province for the generation and production of electrical energy" (92A(1)(c)). If a hydro-electric power plant were to be a part of a large-scale water diversion project, it would appear that it would now come under provincial jurisdiction. However, if this facility were viewed as an integral component of an export undertaking, which, it was argued above, could be partly subject to federal jurisdiction, conflicts could arise. This constitutional amendment seems to have been designed primarily to protect provincial control over hydro sites against the claims of private owners rather than against those of the federal jurisdiction. As it is now, its federal-provincial impli-

cations for water management and for water exports have yet to be tried.[6]

3. Summary - Canadian Legal Aspects

What powers would be exercised in a "typical" water-export project? A responsible agency would be set up; let us assume it is a private firm connected with an American water agency or enterprise. The words "water," "export" and "project" give us heads to show the bounds and overlaps of the two levels of government.

The agency would first have to obtain water. This would certainly require the permission, indeed the encouragement, of the province of origin or diversion. (If the works caused effects on levels and flows in other provinces they too could become directly involved.) The provincial government's near-ownership claim could surely not be disregarded, nor could its existing laws and machinery to expropriate or deal with losses of waters suffered by persons holding private or provincial water rights. (There is some precedent here, for the federal government did assign water rights in one region of B.C. in the 1900s [Cail, 1974].)

Second, the "project" would lead the agency to seek rights over or to private lands, public lands, easements, building materials such as rock and fill, and clearances involving environmental effects, working conditions, and allocation of water along the route to Canadian customers of the export project. All these powers or rights to take or undertake these things would come from the provincial government. The federal Northern Pipeline Agency (NPA) provides an example of a possible arrangement for facilitating the acquisition of the needed rights and powers. Under the Northern Pipeline Act, many powers and responsibilities from federal departments and agencies were delegated to the NPA to provide a "single window" for regulation and coordination of the pipeline's construction by Foothills. Included in the Act were provisions for intergovernmental (federal/provincial) coordination.

Only the word "export" conveys the agency's need for reliance on federal approval powers and encouragement. To start with, the project's canals or diversions might cross more than one province, and the diversion would almost certainly change the present flows in inter-provincial streams and affect fisheries, navigation, railroads and other communications. Since the federal government might well regulate or prevent such undertakings under its existing powers, (for example, the powers in the Canada Water Act, the International Rivers Improvement Act, the Fisheries Act and the

Navigable Waters Protection Act), its intimate involvement and approval would be required.

When the canals or diversions cross into the United States, the need for Ottawa's participation is indispensable. If there were a change in levels and flows at the border it would probably require approval of the International Joint Commission. As well, an "export" would draw in those government departments that are concerned with trade and payments. Furthermore, the day-to-day management of levels and flows within the project itself would require some special international oversight (such as that involved in the International Columbia River Power Board under the Columbia Treaty) even if the exporting agency and its customer in the United States were both private entities. Finally, international caution and the absence of a super-court to enforce any contract would demand a special agreement whereby the American customer was protected against arbitrary interference with water flows and the Canadian exporter given acknowledged freedoms to vary or stop the flows under specific conditions. Such an agreement would involve Ottawa in its diplomatic role, and also in agreements with the provinces concerned. The present arrangements for natural gas provide a useful analogy.

As a result, water export proposals will not succeed without the support and cooperation of both levels of government. While "detailed legal planning" would be required before such a water transfer could go ahead (Percy, 1981:11), it appears that there is sufficient flexibility in the division of powers under the Constitution Act to allow a joint federal-provincial approach to regulation and management of any water export proposals that may arise.

4. International Legal Aspects - United States

The United States also has some jurisdiction in the matter of Canadian water exports, for it may be able to divert water that would otherwise flow into Canada (such as the Red River of the North and Lake Champlain), and can draw on both boundary waters (such as Lake Erie) and waters that flow into boundary waters (such as Lake Michigan in the United States). The Canadian-American rules about such diversions have been settled somewhat in advance of the progress of general international law on the same subject (Bourne, 1974). In 1900, to take a convenient date, there was increasing uncertainty about jurisdiction over such waters, especially about who had rights to obstruct them for power and navigation purposes. Some uneasiness about diversions had cropped up in connection with the Chicago Diversion (see Chapter III) and

irrigation and diversion projects on the St. Mary's and Milk Rivers along the parched Alberta-Montana border, but Canada was especially thoughtful about the 1895 American rejection of Mexico's legal claims to Rio Grande waters diverted before they reached the Mexican border. These questions were dealt with in the negotiations that led to the Boundary Waters Treaty, 1909. With a number of particular exceptions, the two governments agreed that each had exclusive control over and rights to divert waters in rivers crossing the boundary.

This was the "Harmon Doctrine" transferred from the Mexican border -- with however the modification that parties below the border injured by such diversions should have the same rights and access to the same legal remedies as if such injury took place in the country where the diversion was made (Article II). This principle, however, applied only to rivers crossing the border. Another rule was applied to watercourses flowing along the border: the two governments in effect banned obstructions that would change boundary waters levels or flows unless these were approved by the International Joint Commission (I.J.C.) set up under the same treaty (Article III). Note that the treaty has nothing to say about diversions from rivers entering boundary waters; such diversions, therefore, were subject only to domestic law. In any case, the right of injured parties to access or remedy as if that injury took place in the country where the diversion was made has turned out to have little content in Canada. This is because, as we have seen earlier in this chapter, provincial laws covering levels, flow and diversions do not give, even to local citizens, rights (such as riparian rights) to uninterrupted flows.

Finally, the interdependence of the two countries is not to be ignored. Each is downstream of the other on important streams, so that neither can afford to take the lead in making a diversion that might free the other to make a retaliatory diversion on another stream. This recognition of their mutuality is evident in several ways. One of these is the unofficial expectation that when water apportionment is an issue, the solution will be close to an even division of the natural flow. (See Chapter VI for more details.) Nevertheless, international apportionment issues are typically the most bitterly fought matters to come before any tribunal. This is probably because, no water price being charged, parties on each side have every incentive to get as much water apportioned to themselves as possible. The I.J.C., whose members rarely divide on national lines, has several times so divided in apportionment cases. Nevertheless, Canada-U.S. "comity" may be said in the few diversion or apportionment cases that have been at issue to have

led the national parties from the 100 percent Harmon position to the present style of negotiation of solutions in the neighbourhood of 50 percent.

This North American trend has taken place while the global international-law community attempted to make general rules for settlement of international watershed disputes. These attempts culminated in the 1966 "Rules" drafted by the International Law Association (a non-governmental organization) in conference at Helsinki. For our purposes the essence of these Helsinki rules is that each nation is declared to have a duty to take its neighbours' needs for water into account before diverting (Article IV). The convention evidently refused to take the further step of saying that the waters in a basin should be used for the benefit of the basin as a whole, disregarding the frontier (Bourne, 1974)).

More will be said in Chapter III and in Chapter VI about diversions and international apportionments. By way of summary here it may be said that (a) the 1909 embodiment of the Harmon doctrine in the Boundary Waters Treaty gave each country powers to divert waters that would otherwise flow in their natural channels across the border; (b) in spite of this, large diversions have not taken place, and in most great-plains watersheds trans-boundary flows have been apportioned on a fifty-fifty basis; (c) this tendency to share conforms to strengthening international opinion (as exhibited in the Helsinki "Rules" and subsequent formulations) that the upstream country has a duty to consider needs or benefits downstream before diverting trans-boundary waters. These generalisations suggest that under present interpretations of her international powers, Canada could not easily make a demand for compensation for exporting by not diverting waters now running south; nor could the United States easily without compensation or agreement import by diverting waters now running north.

D. Opportunities for Export - American Water Demand

A prerequisite for water exports is, of course, a willing buyer. At this point, it appears an open question whether American water demand will reach a level where Canadian water could economically augment U.S. supplies. There are several large regional areas in the U.S. where water shortages are being experienced or are anticipated if current withdrawal and consumption rates persist. Two such areas are the Colorado River basin, where water allocations from the basin are greater than the river's flow during dry years (Foster and Sewell, 1981:28), and the south-western Ogallala aquifer region, where "annual groundwater mining (overdraft) is equivalent to the annual flow of the Colorado River

(approximately 14 maf [million acre-feet, or about 17 billion m^3])" (Rogers, 1984:41). These over-allocations worry some observers. Powledge opens his recent book on water with the sentence, "The United States has entered a period of grave emergency in its supply of water"(1982:3). Foster and Sewell state that, "It has become evident during the past decade that shortfalls in [the West, Southwest, and western Great Lakes regions of the U.S.] will almost certainly reach crisis proportions by the end of this century unless alternate sources are found in the near future or fundamental changes in demand take place" (1981:20).

This is scarcely surprising, for any rate of flow of anything sustained without change for half a century is likely to promise a staggering surplus or a grievous deficit by the end. Such statements were probably not anyway intended to be taken literally as prophecies, but as warnings that big adjustments in U.S. water allocation and use are to be expected, leading to inquiries about which force is most likely to give. Most experts predict (and argue) that the best candidate for change is the present system of nearly-free sale of water. Peter Rogers, like other experts, feels that the problem is not one of insufficient water supplies but of inefficiency in the ways they are managed, rationed out, and used (Rogers, 1983:80; Wilkinson, 1984:7.8; Powledge, 1982:6). All advocate some system of paying for water.

In most regions with water districts there are already flat-rate annual water charges. These have little or no effect on consumption. Such charges indeed can be quite high, since their usual purpose is to enable the water district to service the initial capital costs of elaborate collection, storage and delivery structures, and also to pay for operation and maintenance. But sometimes they are absurdly low, having been subsidised at an early date by government water programs (Rogers, 1983). It is worth repeating that such fixed water rates either high or low have no important effect on total water consumption for they are not linked to the amount the consumer takes.

A very few water systems do make this linkage. They are to be found in districts that meter their customers' consumption and charge them for the amount taken. One urban example is in the Washington D.C. area, where the Washington Suburban Sanitary Commission in 1978 implemented an incremental block pricing system (Baumann and Dworkin, 1978:23). Typically, the rates charged vary, including extra cents per cfs or acre-foot for the distance the water must be carried and, more important, for the degree of water

scarcity at the time it is consumed. Thus a farm's rate schedule may rise and fall with the time of day and the time of year.

Those who criticise the water management systems in many parts of the U.S.A. are saying two things: too much water (especially well or ground water) is totally free or unpriced; and too many charge schedules are unduly low. Thus for a very large amount of the water consumed in dry regions and for consumers who are attached to city systems and irrigation systems or who pump their own water, there is no incentive to restrict the amount taken daily until falling pressure cuts them off or until the well threatens to run dry. No consumer can gain by cutting down what he draws, because doing so will not lower his total water payments and will not help him to get more water when, in dry periods, he really needs it.

Some U.S. experts go much farther than this: what they ask for is an "efficient" system of management and consumption. This word describes a water-delivery set-up by which the water is divided among the customers in a manner that will maximise the economic benefit from its use. To achieve this, water should be priced so that every consumer's marginal unit of water taken brings in a uniform final value of product, as measured by the amount the consumer is willing to pay for it. In an "efficient" system this uniform marginal value will just equal what it costs to obtain the water from its alternative uses or consumers elsewhere, plus what it costs to deliver it.

Such an efficient system utilises marginal-cost pricing. In many areas the marginal cost of water may well be lower than the annual charge, full price or water tax now paid by members of water systems that have no government subsidy. But it is appreciably higher than the average price paid throughout the dry regions, for most users are not charged anything for their marginal acre-foot. The absence of any charge system (especially of a marginal-cost system) is ascribed by Rogers and others as evidence of lack of "political will" (Rogers, 1983:80).

However much it might be, a marginal-cost charge for already-available water from neighbouring U.S. sources would fall well short of the per-user cost of sending water down from Canada (Wilkinson, 1984:7.8; see also Chapter V of this study). The impoundment, storage and delivery of Canadian water -- not to mention the equally important costs of reimbursing Canadians for present and future economic and environmental water benefits forgone -- would be a very unattractive alternative to developing the

political will to make better use of the water supplies already available in the south and southwestern United States.

Any Canadian pondering a proposal to export water should take this into account. Even where there is an opportunity to export water, the U.S. buyer should be able to and probably will find a better bargain at home. The Canadian should bear in mind the history of the planning, financing and construction of the Foothills natural gas pipeline. This $40 billion project was half built when the U.S. importers belatedly discovered in the late 1970s that gas from the contiguous states would be less expensive than Alaskan or Canadian supplies. This has led to financing difficulties and project delays, so that it is now uncertain when, or even if, the pipeline will be completed.

E. Water Surpluses in Canada - Canadian Water Supply

Let us leave economics for a few paragraphs and consider where our water is. If the national statistics for average surface water flows are compared to those for water use, it would seem that Canada has a great surplus of unutilized water. For example, the total Canadian monthly reliable flow (which is the lowest monthly flow experienced in 10 years) was about 1,711 million m^3 per day, while total withdrawals in 1980 were estimated at about 120 million m^3 per day -- about 7 percent of the monthly reliable flow (Environment Canada, 1983:13). However, the distribution of water in Canada is not spatially or temporally uniform. Foster and Sewell remind us that "much of the water is in the wrong place or is available at inappropriate times" (1981:17). A study by the Canada West Foundation points out that, in western Canada, "over 80 percent of the natural water supplies are contained in an area populated by fewer than 10% of the region's people"(1982:p. xx), and that in the same region "over 60% of the total annual water flow passes through the prairies on its way to Hudson Bay during a three-month period"(1982:p. xxiv). As a result, local water shortages are foreseen by some in certain basins in southern Canada (Foster and Sewell, 1981:17). Not all observers agree with this conclusion. Veeman argues that such a forecast has two "major economic difficulties": it assumes that water is a free good; and it ignores "economic alternatives" (demand management, for example) for coping with water shortages (Veeman, 1984:21). Therefore, Veeman suggests that labelling these southern basins as water-scarce may be premature (1984:22).

Overshadowing the arguments and uncertainty about short-term water supply and requirements is the problem of the effect of long-

term climatic change on Canada's water needs. A growing body of evidence suggests that Canada's climate may undergo what would be in a geological sense rapid warming. This warming would be a manifestation of the "greenhouse effect": increasing concentrations of carbon dioxide and other pollutants in the atmosphere -- largely as a consequence of human actions -- is thought to be causing the earth's surface temperature to rise (Hare, 1984:73). If this warming trend continues, it could affect Canada's hydrologic cycles and could dramatically alter water supply and demand across the country (Hare, 1984:81). There would probably be less water available to divert out of Canada to the U.S. if this type of climatic change occurred. Although, as Hare points out (p. 82), there is considerable uncertainty about the timing and severity of these climatic changes, their likely effects on Canada's water resources (increasing demand and reducing supplies) would have to be taken into account when attempting to establish whether Canada has an exportable surplus of water.

F. Concluding Remarks

Seven important points arise out of the sections in this chapter. First, most water-export-caused effects of the change in water levels and flows would be experienced in the environment rather than in physical use.

Second, water is largely consumed privately, and private users have "rights" that can be changed only by major political interventions.

Third, private rights however are no longer closely linked to private property in land. They have been replaced by various systems of water law that more or less transfer proprietory rights to the provinces. Private use derives from provincial granting of water rights.

Fourth, both the provinces and the federal government possess formidable powers under the Constitution to help or hinder a private water-export proposal. Undoubtedly, success in a water export proposal would require cooperation from both governments.

Fifth, there is a considerable U.S. "demand" for more water, especially in the dry southern regions, where surface and ground water flow more or less freely (without price) to private users. However this demand may not be adequate to justify investment in bringing water from Canada, given that water-pricing could liberate

large squandered flows from inessential uses today, and make water available at smaller real costs than water imports.

Sixth, whether a "water surplus" exists in Canada also depends on economic considerations, among them the question of whether various "scarcities" in southern Canada do not also reflect the same "pricelessness" that afflicts American water consumption.

Seventh, any forecast of Canada's water supplies and demand should consider the long term as well as the short term. Large-scale water export projects would probably be feasible only if water could be diverted over long periods -- decades -- to the U.S. This would require commitment of a large volume of Canadian water. Over the long term both U.S. and Canadian demand for water may increase due to economic growth and climatic changes. Although it will be difficult to estimate this long-term demand, the time frame for the supply (water surplus) forecast must have about the same length.

Endnotes to Chapter II

1. The study cited is: Taylor, 1967 (see list of references). By way of comparison, the mean annual flow of the Northern Saskatchewan River at Edmonton from 1912 to 1975 was about 7725 cfs (218.8 cubic metres per second) (Canada West Foundation, 1982: 109).

2. Detailed discussion of social costs of pipeline construction may be found in the Report of the Berger Commission on the Mackenzie Valley pipeline (Berger, 1977).

3. This section is influenced by Campbell et al., 1974 (see references).

4. The excerpts from the Constitution Act quoted in this section were taken from: Canada. Department of Justice, 1982 (see list of references).

5. Another potential source of federal authority is the "declaratory" or emergency clause of section 92(10(c)), (working with section 91(29)). Section 92(10(c)) excepts from provincial legislative jurisdiction,

> 92(10)(c) Such works as, although wholly situate within the Province, are before or after their Execution declared by the Parliament of Canada to be for the general Advantage of Canada or for the Advantage of Two or more of the Provinces.

Such a declaration would not empower Parliament to forever remove certain classes of projects from provincial jurisdiction -- it could only be applied to existing or contemplated works and undertakings. Neither would it give Parliament complete control over all aspects of water export, but only over "works" -- the provinces retaining other powers. In view of the federal jurisdiction that could be established under other heads, it does not appear that the federal government would gain much additional control over exports through an emergency declaration.

6. In a 1981 case (Fulton v. Energy Resources Conservation Board) the Supreme Court of Canada held that Alberta had powers to regulate and approve a transmission line to interconnect with a B.C. line and so, indirectly, with the United States.

Lucas and Saunders (1983:10-11) summarize the Court's judgement as follows (footnotes omitted):

"The Court held that the province had jurisdiction to regulate electrical transmission facilities that were wholly within its boundaries. That the transmission facilities are intended to be connected with those of an agency outside the province did not bring the matter within exclusive federal authority. The provincial legislation is valid so long as it does not purport to regulate the interconnection. It is a matter within provincial authority in relation to local works and undertakings under s. 92(10). The situation was particularly clear in the absence of federal legislation to regulate interprovincial power lines. Had such legislation existed, it is possible that a direct conflict with the provincial legislation could have been found that would have given the federal government jurisdication on the basis of paramountcy.

"There are implications of Chief Justice Laskin's judgment that the result might have been different had the proposed transmission line interconnected with a line owned and operated by the same utility in another jurisdiction. This would be consistent with cases that have found operations such as railways and motor transportation systems to be single inter provincial or international undertakings and, therefore, subject to federal jurisdiction under s. 92(10)(a). This part of the Supreme Court's opinion suggests that interconnected transmission facilities spanning several provinces and U.S. jurisdictions are not likely to be characterized as single works or undertakings. Systems are put together by provincial utilities through construction of system components within provincial boundaries. This fact is likely to exclude full federal regulatory control of both energy development and construction of facilities for interconnected systems which are developed through coordinated planning."

CHAPTER III. EXISTING AND PROPOSED WATER EXPORTS AND CANADIAN EXPORT POLICIES

The preceding chapter provided an introduction to the issues -- economic, environmental, legal and political -- associated with water exports in general. This chapter examines water exports at a less abstract level, presenting in the first two sections a survey of existing and proposed water export projects. The third section of this chapter briefly discusses current Canadian policies for exports of certain other natural resource commodities. That overview provides the context for the fourth section of this chapter, which examines past and present Canadian water export policies.

A. Existing Canadian Water Exports

Although many Canadians may feel that water exporting is a new idea, small amounts of Canadian water have been diverted to American uses for a number of years. One example is in the Great Lakes region. In 1848, the U.S. unilaterally diverted water from Lake Michigan through two canals into the Illinois basin (Carroll, 1983:126). This diversion, known as the Chicago Diversion, provided water to dilute pollution entering the Illinois Waterway from Chicago, and to improve navigation and power generation downstream in the Illinois Waterway and the Mississippi River (into which the Chicago Diversion ultimately drains) (Carroll, 1983:126; I.J.C., 1982:7). The flow of water through the Chicago Diversion has averaged 3,200 cfs (about 90 cubic meters per second, roughly equal to 1.7% of the average flow of the Detroit River, which drains the same body of water) since 1970 (I.J.C., 1982:2).

This water taken from Lake Michigan appears to be replaced to a limited degree by water diverted through the Long Lac and Ogoki diversions in northern Ontario. In the Long Lac Diversion water from the Kenogami River basin, which drains into James Bay, is moved through Long Lake and the Aguasabon River into Lake Superior. In the Ogoki Diversion water from the Ogoki River, which drains into James Bay, is sent back through Lake Nipigon and the Nipigon River into Lake Superior (I.J.C., 1982:4,7). The volume of water diverted averages about 5,600 cfs (about 140 m^3/s)(I.J.C., 1982). These two diversions were intended to increase Canadian hydro-power generation capacity along both the Nipigon and Aguasabon rivers and further downstream in the waterways connecting the Great Lakes. However, if some of the water diverted into Lake Superior from Canada compensates for the withdrawal at Chicago, this could be considered a form of water export. Likewise, any increase in the volume of the Chicago Diversion as has been proposed from time to time (Carroll, 1983:126-7), compensated by increased Canadian diversions into the Great Lakes thus maintaining water levels for navigation and power, may be construed as a water export. Carroll predicts that "[p]roposals to increase the Chicago Diversion ... will be a recurrent theme at various times in the future..." (1983:127). The Chicago Diversion has the capability to handle much larger volumes of water. Flow rates through the diversion reached 10,000 cfs (283 m^3/s) in 1928 (I.J.C., 1981:4-10). It should be pointed out that this diversion is a rather tenuous example of an export, and is not officially considered a water export.

This example illustrates how the patterns of North American drainages makes it comparatively easy to arrange water transfers or exports between any two points. "Minor" water transfers can be local or can cover thousands of miles. Another example of minor water transfers to the U.S. is that of small delivery systems that carry municipal water a few miles to adjacent towns across the border. Thompson, writing in 1982, mentions a sale of water by the town of Coutts, Alberta to the neighbouring community of Sweetgrass, Montana. According to Thompson (1982:53), Coutts charges Sweetgrass $1.90 per thousand gallons (about $0.42 per m^3) for the water, exported by a pipeline. (Thompson does not indicate the volume of water exported to Sweetgrass.) In return for water from Coutts, Sweetgrass' power and natural gas utilities have been extended to serve Coutts (Thompson, 1982:53). These small-scale water transfers have not received a great deal of public attention -- though they are, we have argued, types of water exports. However, these small water transfers cannot be portrayed as precedents for large-scale exports such as river diversions.

The volumes of water and the costs involved in these examples are trivial in comparison to diversions of rivers.

B. Proposals for Water Exports

In the early 1960's, in response to predictions of water shortages in some areas of the U.S. (especially the southwest), a search for new sources of supplies was begun. To many of those searchers, Canada seemed to be an obvious source. This has led, starting in the mid-1960's and continuing to the present, to a number of proposals for large-scale transfers of water from Canada to the U.S. These proposals are summarized briefly in this section.[1]

1. The North American Water and Power Alliance (NAWAPA)

The most famous, or perhaps the most notorious, of the water export proposals is NAWAPA. Proposed in 1964 by a private firm of engineering consultants, the Ralph M. Parsons Co. of Los Angeles, NAWAPA would divert massive volumes of water from Alaska and northern Canada to southern Canada, the southern U.S., and Mexico (Parsons Co., 1964). The plan would involve flooding an 800 km length of the Rocky Mountain Trench (primarily in British Columbia) and the construction of "at least 50 different diversion and control works, including dams, canals, tunnels and reservoirs" (Sewell, 1969:356). Included would be one 190-metres-wide by 11-metres-deep canal to the southern U.S. and one 23-metres-wide by 9-metres-deep canal across the Canadian prairies to link up with the St. Lawrence Seaway (Sewell, 1969:356). The total volume of water diverted could be as much as 250 million acre-feet (about 310 billion m^3) per year, a volume roughly equivalent to the average total annual discharge of the St. Lawrence River. The cost of the project was estimated in 1964 to be approximately $80 billion to $100 billion (Parsons Co., 1964:4), which would be $280 billion to $355 billion in 1984 dollars.[2] These estimates reflect only the cost of building the project, and includes $16.6 billion (1964 $) for land acquisition and community relocation. The proposal completely ignores the social and environmental costs of the plan, which would be astronomical.

It is not clear how seriously the Parsons company meant their elaborate project to be taken. Their public exposition of it was not extensive and it was not submitted to any government. Discussion chiefly amounted to little more than text surrounding frequent reproductions of their map, across which new lakes and waterways were slashed until North America began to resemble

Schiaparelli's depictions of the canals on Mars. Was it an integrated, indivisible illustration of man's new-found earth-moving technology, wealth, and confidence? It is noteworthy that in the same decade other massive projects were suggested to divert Russian and Siberian rivers into the Volga River and the Black and Caspian Seas; to link the Nile with the western desert lowlands and the Mediterranean; to harness the tides of the Bay of Fundy and the English Channel; and to link France and England by a multi-tube tunnel.

The very large St. Lawrence Seaway and Columbia River projects were just completed, the northern California irrigation canals and the Aswan Dam were just ahead. It was a decade of exciting mega-projects. With so many visions ahead shared and so many kites already flying, the Parsons people must have been taken aback by the vigour of the reception of their brainchild. Thanks to this proposal, water exports now not only seemed a tangible possibility but seemed, more so than had been suggested by the Columbia, St. Lawrence or Fundy projects, sprawling and indivisible, their construction based on indifference to Canadian wants or needs and to newly-awakened environmental ideas. The title of Richard Bocking's book, Canada's Water: For Sale?, by an author who had already in TV productions chronicled the comparatively minor upsets of the Columbia Treaty projects, clearly signalled the hostile reaction that NAWAPA evoked. The disconcerting reception a few years later to Energy Minister Greene's reliance on a "continental" pattern of petroleum distribution was surely a symptom of this new hostility.

All this was healthy, encouraging wide-spread discussion. It probably was responsible for the decided view of many Canadians that all water exports should simply be "banned". It is, however, unfortunate that the proposal's introduction as an indivisible hundred-year-long conquest of North American watershed geography should have obscured the essential divisibility of smaller projects and their high potential to make technically significant contributions with relatively small volumes of water. This inflated image was only partly remedied by a succeeding wave of other proposals for water transfers to the U.S.

2. The Central North American Water Project (CeNAWP)

The Central North American Project was developed by Dr. E.R. Tinney in response to NAWAPA, which he felt "does violence" to basic engineering precepts of minimizing environmental impacts and using natural features as much as possible (Tinney 1967:23). The

proposal would transfer water from Canadian basins as far north as the Mackenzie via a series of pumping stations and canals along natural prairie drainages to Lake Manitoba and Lake Winnipeg. From these, water would be diverted to Lake Superior through Lake Nipigon, and thence to the southern U.S. through the Missouri/Mississippi basin. Even though the CeNAWP project would rely on natural drainages wherever possible, as much as 4,000 km of canals would be needed (Bryan, 1973:160). No cost or water volume estimates were made, as the project was intended only as a conceptual alternative to the NAWAPA project. According to Bocking, Tinney's CeNAWP project "was put forth only to show that a much better scheme than NAWAPA could be devised if necessary" (1972:74). It was not intended to advocate water exports from Canada.

3. The Kuiper Diversion Scheme

The Kuiper Diversion scheme, first published in 1966 by Professor E. Kuiper of the University of Manitoba (Kuiper, 1966), has a number of features in common with the CeNAWP proposal. It too would divert water from the Mackenzie drainage into rivers across western Canada to Lake Winnipeg. From there, water could be diverted east to the Great Lakes or, by reversing the Souris River, south to the Great Plains region of the United States. Kuiper's plan involves a number of stages, first transferring water within Canada from progressively further northerly basins, then an export component that would see a distribution network extended southward into the U.S. in three stages using existing drainages where possible. The diversion scheme would have delivered water to central Texas at an estimated transfer or construction cost of $35 per acre-foot (about $97/1000 m^3 in 1984 dollars) (Kuiper, 1966:15). Again, this figure does not include opportunity costs, environmental costs or a "resource rent" for the water.

4. Western States Water Augmentation Concept

This water transfer proposal, first published by L.G. Smith in 1968, would use the western Canadian drainages and the Rocky Mountain Trench to move water to the southern U.S. Although this plan does not include NAWAPA's 800 km reservoir in the Rocky Mountain Trench, it does call for diversion of waters from as far north as the Liard basin south through the Trench, where the water would be transfered through tunnels or canals through the Fraser, Columbia, or Kootenay rivers to the U.S. Some of this route would thus redirect or prempt storage and channels now dedicated to the existing Peace and Columbia river schemes. A second component of

the project involved transferring water from the Smoky, Athabasca and Saskatchewan rivers through the Qu'Appelle or Souris River to Lake Winnipeg, from which, presumably, water could be diverted south.

According to Quinn (1973:16), the Western States Water Augmentation Concept would yield about 47 billion m^3 per year, and would cost approximately $75 billion to construct (about $295 billion in 1984 dollars) plus costs within the U.S. Like the Kuiper project's costs, this cost does not include opportunity or environmental costs.

5. The Magnum Diversion Scheme

The Magnum Diversion Scheme, first proposed by Knut Magnusson in the late 1960's, is another western Canada diversion project which, Bryan says, "was put forward more as a suggestion for further consideration than as a detailed plan" (1973:164). The proposal would divert water from the Peace River basin via the Athabasca, North Saskatchewan, Battle, South Saskatchewan and Qu'Appelle drainages to the Souris River, through which the diverted water would be exported to the Great Plains region of the U.S., and then further south through the Missouri River. The plan included no estimate of project costs nor of deliverable water volumes, and "it does not appear to offer significant improvements on the Kuiper scheme" (Bryan, 1973:165). It should not be considered in isolation however, but as part of a growing interest in Alberta in long distance water transfer.

6. The Great Recycling and Northern Development (GRAND) Canal

While the preceding five proposals for water diversions have been partly cancelled by other water projects in the same basins and in any case are largely matters of historical interest (dredged up from time to time for studies of water exports) the GRAND Canal concept is still being actively advocated by its originator, Thomas Kierans. Kierans first proposed the concept in 1959 (Quinn, 1973:16). In 1984 he presented a new version of his project in writing to the federal Inquiry on Water Policy (Kierans, 1984). Kierans' project was initially intended to provide a source of fresh water which could be used to regulate the levels of the Great Lakes (a gigantic problem with which the two governments, the I.J.C. and millions of lake riparian owners and users continually wrestle); water exports were a by-product (Kierans, 1965). Kierans' solution was originally an extension of the existing elements in the Great Lakes level management system. His diversion

however, would also permit greater withdrawals from the Great Lakes by both Canada and the U.S., so that it eventually became known as a water export project. It calls for James Bay to be turned into an immense freshwater reservoir by building a dyke across the Bay where it meets Hudson Bay; the water from the reservoir would be pumped and diverted south through a series of canals and the Ottawa River to the Great Lakes (Kierans, 1984:3). Because the water would not be diverted out of natural drainages, but would be collected after the rivers drain into James Bay, Kierans refers to his plan as water "recycling", not diversion. Water would be transferred to the U.S. through the Chicago Diversion and possibly other diversions. Kierans in 1984 estimated that the project would cost about $100 billion to construct over a period of eight years (Kierans, 1984:7). This figure does not appear to include other than construction costs (no opportunity costs, environmental costs, etc.); nor are water transfer volumes indicated.

7. Freil Lake Tanker Proposal

This water export proposal, developed by Colin Beach of Coast Mountain Aquasource Ltd. of West Vancouver, is currently in the planning and approvals stage (Anon., 1984). It differs from the previously-described water export proposals in several important ways. First, the amount of water involved in the project would be trivial in comparison to a large-scale overland river diversion. Second, very little permanent infrastructure would be necessary, as the proposal is for water to be shipped by tanker to the southern U.S. and Mexico. The only infrastructure requirements would be some moorage facilities in Hotham Sound where water will be taken on, a water control structure on Freil Lake (about 90 kilometres up the Sunshine Coast from Vancouver), and a road into the dam. Finally, the environmental impacts of the project would be few and small, especially in comparison to inter-basin water transfers. As Freil Lake empties into the ocean through a waterfall, there are no fish movements to be affected by construction of the dam at the lake's outlet (Beach, 1984). The chief opportunity cost of the export project would seem to be that its approval might prevent more valuable potential engineering and environmental uses yet to be proposed.

Perhaps the most important aspect of the project from an exports policy perspective, is the flexibility and interruptibility of the water deliveries. An often-expressed concern about overland water transfers, with their apparent long-term commitments of water to justify tremendous infrastructure requirements and costs, is

that it may be very difficult to "turn off the tap" if this is suggested by increases in future Canadian demand or scarcity. Water exports by tanker, however, could be interrupted much more easily -- meaning that a policy decision to export water by tanker would not be as costly to reverse.

8. Summary

Although the various proposals for large-scale water transfers from Canada to the U.S. have generated controversy and debate over the last 20 years, it appears that Canadians need not expect the imminent diversion of Canada's rivers to the U.S. Most schemes were proposed primarily to stimulate discussion of alternate engineering means of transporting water and were not closely linked to particular water-short regions or users. On that level they appear to have been successful. None of the large-scale diversions described above has ever approached the multi-million dollar stage of detailed planning. The proposals may in general be technically feasible, but their economic feasibility has hardly even been suggested. The extent to which they would cause widespread environmental and socio-economic disruptions and consequences received only passing attention during the 1960s. Containerized water exports such as the Freil Lake proposal appear to be much more feasible, primarily due to their much smaller scale and greater interruptibility. Of course, containerized exports may not be feasible means of meeting large demands for water in the U.S.

It is interesting to note that many of the water export proposals have been put forward by Canadians, not Americans. While some private Americans have expressed interest in importing water from Canada, Shaffner et al. (1980:564) point out that the U.S. government has never officially supported long distance large-scale water transfers from Canada.

C. Current Federal Export Policies for Other Resource Commodities

Canada's economy is based to a large extent on the production of natural resource commodities -- both renewable and non-renewable -- for export markets. The federal government's export policies for the various commodities range from a hands-off approach to close scrutiny and regulation of exports. This section briefly outlines current federal policies for exports of electricity, natural gas, forest products, minerals, and grain, to illustrate the range of federal export policies.

1. Electricity Exports

Canada has a long history of trade in electrical power with the U.S. The first notable trade in electricity began around the turn of the century (1900) when hydro-electricity generating stations were built at Niagara Falls, Canada (Miller, 1970:10). Energy from these stations was exported to American cities across the Niagara river -- Buffalo, Lockport and Syracuse -- as well as serving Canadian customers. The Canadian market was small and the early developers were mostly interested in serving U.S. industry and industrial towns.[3] Although the Ontario government passed export regulatory legislation, and the newly-formed Ontario hydro agency attempted to limit the commitment of firm power to the U.S. market, the amount exported increased steadily. Ottawa established an export regulatory regime, and the U.S. Congress and interests in New York state -- alarmed by the possibility that Canada might unilaterally switch exports off -- also undertook to use their powers to limit imports into the U.S. market. Nevertheless exports continued to grow, both from Quebec and Ontario. Grauer and Davis (1961) estimate that by 1910 one third of the energy from Canadian central generating stations (i.e. not tied to particular users) was exported, and the amount licensed and exported increased up to 1917.

During the war the situation became tense. Canada was advanced in plans to manufacture electro-chemicals for munitions, and power was needed. It turned out that all Canadian capacity was either used or committed to exports. Negotiations between Canadian generating firms, the U.S. government, the U.S. coal industry (for fuel to supplement Niagara hydro generation) and the Ontario government eventually enabled the Canadian war power controller to scrape together and apportion enough for all users, and the crisis ended in 1919.

But the power export "issue" became more acrimonious over the next twenty years. In Ottawa, Quebec and Ontario successive debates revealed that the war experience had suggested to many that licensed exports, in spite of their explicit terms, had been treated by the exporters and their customers as irrevocable and permanent. Sir Henry Drayton, who had been power controller, expressed the sentiment that always "power exported is power lost". The matter came up repeatedly in all capitals in connection with new power projects, and it became usual not to licence "firm" power exports.

Large-scale exports of electricity to the U.S. again became an important issue during the negotiation of the Columbia River

Treaty. To obtain provincial support for the treaty, the federal government announced that it was prepared to authorize power exports to the U.S. for the following purposes, among others:

- to provide for sales of surplus interruptible energy;...[and]

- to provide for exports of firm power for limited periods [up to 25 years] to make possible the step by step construction of the most economical generating facilities on either side of the boundary (Miller, 1970:251).

Since 1959 the export of power has been regulated by the National Energy Board (NEB); this specialist body (partially modelled on the U.S. Federal Power Commission, which exercises jurisdiction over imports) has replaced the necessity of legislative debates on each proposal. Before electricity may be exported to the U.S., "the NEB must determine that the export quantity is in surplus in relation to foreseeable Canadian electricity needs and that the price is just and reasonable in relation to the public interest" (Perlgut, 1978:37). According to Perlgut (1978:37), the NEB expects export prices for electricity to be at least as much as domestic prices, preferably higher. And, although the NEB is authorized to issue long-term licences for power exports, Perglut says that export licences are "frequently" limited to five years (1978:37).

To the extent that much of the power Canada exports to the U.S. is produced by hydro-electric generators, we are exporting a renewable resource. Since the great war years, the various American and Canadian power distribution systems have become almost completely inter-tied, primarily to provide back-up sources of power and to increase efficiency of power supply, with the result that we now have, in essence, a continental power grid. This means that further exports of power from Canada do not require the construction of new infrastructure to handle the exports. This is an important difference from exports of electricity and water from Canada, as capital costs for transporting new electricity exports would be very small in relation to those of new water exports.

2. Natural Gas Exports

The export of natural gas from Canada is closely regulated by the federal government.[4] The National Energy Board is also the principal federal regulatory body. Under section 83 of the National Energy Board Act of 1959 the NEB is authorized to grant

licences for exports of natural gas (as well as for oil and electricity) as long as it is satisfied that:

(a) the quantity . . . to be exported does not exceed the surplus remaining after due allowance has been made for the reasonably foreseeable requirements for use in Canada having regard, in the case of an application to export gas, to the trends in the discovery of gas in Canada, and;

(b) the price to be charged by an applicant is just and reasonable in relation to the public interest (Lucas and Bell, 1977:22).

In its deliberations the Board relies to a large extent on information supplied by the industry it regulates. This includes the provinces owning the resources to be exported. It has also exercised a considerable degree of discretion in its calculations of surpluses. The NEB has since its creation treated oil and natural gas "simply as trade products" (Lucas and Bell, 1977:8), and has not been reluctant to authorize the export of any gas that it has deemed surplus: "the Board has always taken the position that any surplus gas or power is prima facie exportable" (Lucas and Bell, 1977:22).

In addition to allocating gas for export, the NEB also regulates individual export projects. For example, in the second phase of the 1982 Gas Export Omnibus Hearing, the NEB examined and reported on the economic, contractual, regulatory and other aspects of the 29 applications the Board had at that time received for new or altered gas exports (NEB, 1983:2). The Board is also involved in the ongoing regulation of these (and other) gas export projects.

Presumably because of the economic importance of the natural gas industry in western Canada and its contribution to revenues and the balance of payments, the federal government's policy toward natural gas exports has been in recent years less restrictive than supportive. It has even negotiated cuts in the price of exported gas to maintain or increase the penetration of Canadian gas in American markets.

3. Exports of Forest Products

The Canadian forest industries export both logs and chips and manufactured lumber, pulp and paper and finished wood products. The federal government's policy on these exports is, generally, to permit exports of manufactured products while restricting the ex-

port of primary and intermediate products. In exercising its authority under the Export and Import Permits Act, it follows the lead of the provincial governments when issuing permits for primary and intermediate wood products. (The provinces have long exercised their landlord's power to control the export of logs cut on provincial Crown lands.) Such export controls are intended to stimulate manufacturing in Canada: "Both the federal and provincial governments restrict exports of unmanufactured timber . . . with a view toward promoting the domestic manufacturing industry" (Pearse, 1976:305 and E2).

4. Exports of Minerals

Since the second world war the federal government has encouraged the export of Canadian minerals, as long as the minerals to be exported are surplus to Canada's domestic needs. The federal government uses the same law to control mineral exports as log exports: the Export and Import Permits Act. Under this Act, "Canadian producers were [and are] still required to meet domestic needs before export licences could be obtained" (Wojciechowski, 1979:55). This Act has been used to control exports of copper, nickel, and lead during periods of shortages in the last two decades (Wojciechowski, 1979:56). A similar policy has been followed for exports of uranium since the war (Wojciechowski, 1979:53-4). The provincial governments can control mineral exports by setting the terms of leases of mineral rights, following their practice with log exports. Precedents for this do exist (for example in encouraging the setting-up of within-province smelting and refining plants), but they are infrequent.

5. Exports of Grain

According to Wilson (1979), "Seventy-five percent of the grain handled by the licensed elevator and transportation system is exported from Canada. Export markets are therefore of vital significance for Canadian grain" (1979:327). The federal government has actively regulated these exports.

The federal government's main instrument in its grain exporting activities is the Canadian Wheat Board. Other countries have established agencies that are responsible for importing grain; these "usually purchase Canadian wheat, oats, and barley directly from the Canadian Wheat Board" (Wilson, 1979:344). (Private Canadian dealers are also involved in the international grain trade, although to a lesser degree [Wilson, 1979:344].) The Board is involved in virtually all aspects of grain exports, including

negotiating prices and volumes for Board grain exports and developing export markets (Harvey, 1981:32). It can, and has, forbidden the export both of its own wheat and that of private dealers.

6. Summary

Three lessons emerge. The first is that the federal government has set up agencies for controlling the exports of several natural products. The second is that it has developed fairly complex policies to guide its export-control agencies, sometimes intended to promote foreign sales and their prices and sometimes to protect Canadian consumers and processors. The third is that these agencies share power over most exports with provincial departments. Given these general terms of reference, the agencies rely on the economic climate, not electoral factors, to play the primary role in determining how much of each commodity should be exported. As will be discussed in the next section, this has not been the case in Canada's export policies for water.

D. Current Canadian Water Export Policy

As was shown above, Canada has not failed to export its natural resource commodities -- ranging from renewable resources such as grain and lumber to non-renewable, strategically important resources such as oil and natural gas -- when the opportunity presented itself. Canada's water, however, has in general been an exception to this rule.

The reason for this is primarily economic -- export proposals have not been vigorously promoted. Another reason is that export permission might well have been refused, for water has not been regarded as an economic commodity. Water -- in the form of rivers, lakes and other streams and waterbodies -- has strong cultural importance in addition to its physical importance to human life and activities. Quinn (1969:245) writes that water

> . . . is an integral element of the environment . . . Because the river or lake has always been there, because it permeates so many aspects of their daily lives, directly and indirectly, small wonder that the people of a region or country perceive water as their heritage, to which they have first, if not exclusive, right.

This "emotional" dimension to water may have had an important effect on government water export policies. Over the past twenty years, the stated policy at both the federal and the provincial level has been one of "no water exports". At the federal level,

Thompson (1982:53) says that water exports to the U.S. have been "rejected . . . as a possibility". In August, 1984, Charles Caccia, then federal Minister of the Environment, stated

> that Canada's position to oppose the export of water hasn't changed . . . We reject the contention that water is available for export. This will be a very important commodity for Canadians in the decades ahead. We therefore reject any such notion whether it comes from provinces, municipalities or regions in the north . . . Our position on that is clear and consistent (Anonymous, 1984).

While the federal policy may be clear, it is not entirely convincing, for no serious campaign has been launched to test the government's firmness[5].

At the provincial level the declared situation is the same. Alberta's official position is, "water not for export". In Alberta,

> priority of water use and allocation is based firstly on Provincial, secondly on interprovincial, and finally on national considerations, and will not be influenced by international considerations (Alberta Environment, n.d., p. 14).

The one exception to this is the sale of water by Coutts, Alberta to Sweetgrass, Montana (see section III.A). British Columbia's policy is presently one of "no exports", although this position may be softening (Anonymous, 1984). The federal and provincial export policies are such that water export proposals are, in general, "not being considered by either the federal or provincial governments" (Canada West Foundation, 1982:87). But they are not being advanced either.

The role of the "emotional dimension" in statements of our water export policies in Canada cannot be over estimated. In fact, that dimension appears to have been more important than all others. Exports have been opposed "as a matter of principle", an ad hoc principle unrelated to ecology, economy, comity, or future need.

Endnotes to Chapter III

1. A more detailed review of these projects (with the exception of the Freil Lake project) can be found in Bryan (1973:151-168). The overviews in this section are based to a large extent on Bryan's review.

2. Cost estimates were converted to 1984 dollars using Statistics Canada's Non-Residential Construction Input Price Indices (Catalogue #62-007). Unless specified as 1984 dollars, the costs given in this section are in current dollars (that is, the value of the dollar at the time each proposal was first presented).

3. The next three paragraphs are derived from a pioneering study by Grauer and Davis (1961).

4. The provincial government can indirectly regulate gas exports by regulating gas production at the wellhead.

5. The most recent published federal water policy statement (in 1978) makes no mention of water exports (Fisheries and Environment Canada, 1978).

CHAPTER IV. TYPES OF WATER EXPORT POLICY

A. Introduction

A country may be said to have adopted a "policy" about water exports when it has prepared itself in advance to deal with new situations as they come along. Looking backward, the word policy is often used merely to describe the sequence of actions the government took in a particular area, as in "Canada's mineral policy, 1945-1985". But when used to apply to future actions, policy refers to the government's preparedness: its published readiness to deal with new proposals or opportunities in a particular way, as in the Liberal administration's 1970's policy toward foreign investments.

Preparedness is a quality that comes in three sizes, policy being the middle one. The least-prepared government is one that is passive. It responds to each new problem or issue in an ad hoc manner. That is perhaps how Canada responds to new problems of foreign emergency aid or reception of refugees. Each time, the authorities must attempt to obtain information, weigh the various choices, set up a special administration or agency, and, following events very closely, attempt to learn whether the manner and amount of its actions were appropriate to Canadian political reactions.

The extreme opposite to this minimal state of preparedness is what might be called a "programme". When a programme exists the government is set to take specific actions. Indeed, in a fully programmed governmental area, there may be contingent plans avail-

able for each foreseen future situation. In any event, a water export programme might be just as elaborate as a government's activism suggests: its plans may approximate a dated schedule of activities to be undertaken when the word is given, activities to obtain technical, meteorological, and environmental information; to construct works, to raise finances, to liaise with other agencies and so on. (Of course if prior thinking had induced the government never to export water, the programme's many activities would be zeros.)

To have a "policy" is to have avoided both the unpreparedness of being purely passive and reactive and the super-preparedness of having an active program in place for every contingency. To have no more than a policy is to recognise that in our mixed economy, many of the challenges and opportunities that may be presented for public choice are unforeseeable. Consequently, the wise government neither walls itself up behind the Maginot Line of complete negation nor does it keep its door on the latch to every approacher. Instead it compiles a certain amount of information in readiness for any initiative and it clarifies its own reactions to typical proposals; it tests the powers and jurisdictions of citizens and of all levels of government. These done, it may be said to have a "policy", for the implementation of which it may even set up certain agencies and procedures.

Has Canada customarily had a water export policy up to now? Probably not. Almost all past water projects, from regional to international, would seem to have fitted the "purely passive" description. Most present water power, water-supply, navigation, hydroelectric and irrigation water impoundments and diversions originated with private (or municipal) promoters. Government simply reacted, in a host of ways. It is true that one way of reacting was to set up a legislative framework, such as we see now in provincial water and irrigation acts and in the federal Boundary Waters Treaty. But these responses were made after private proposals had twisted themselves into public problems; they were not the embodiment of policies or programmes thought out in advance of private initiatives. Indeed, it is difficult to find recent examples of active government programs in the water field: possible candidates would be the mid-20th century scheduled widening of all the links in the St. Lawrence canal project and the partly-planned assembly of components for some municipal water-supply systems.

Let us then concentrate on what policy should be. When a government has obtained some information; tested its powers; and clarified its general attitudes, it is ready to take two essential

steps that may be said to confirm the existence of a policy. First, it signals: it publishes a message so that all who would propose water-export projects will understand what kind of political reception they are likely to be up against. Just as important, it sets up a procedure so that all who would propose will know what steps they should take, what information they should present and what payments they should offer.

When, eventually, government has constructed some statutory mixture of message and procedure for handling further water proposals, it has usually assigned two roles to itself, stemming respectively from its proprietory and its regulatory powers. Provincial water acts, for example, are primarily useful for handling private proposals to utilise or transport government-owned water. Other legislation, however, such as that governing the obstruction of boundary rivers or the setting-up of irrigation districts, is an exercise of more general governmental powers not relying on public water proprietorship.

The message in such policies conveys government's general attitude on questions of national advantage or interest. Imports must pay a duty unless they are of a class or kind not made in Canada; investors must pay attention to ownership and control by non-Canadians; broadcasters must see that their productions have Canadian content; employers must not attempt to bring in talented outsiders when Canadians are available. There is also a narrower category of export policies in which the message is that only when particular conditions are met will government permit electricity, uranium, oil, gas, logs and certain other goods or services to be exported. Occasionally it is proposed to add to this list: that students may not take their talents abroad until or unless they have repaid the state for their education; that Canadian technology should be kept for the benefit of Canadian industry, and so on. Perhaps the unfamiliarity of these suggestions will illustrate how much more inclined Canadians are to proclaim their intention to restrict imports of goods and services than to restrict exports. But export-control messages are easy to signal, and have proved not too costly to enforce.

Enforcement of a policy message requires a policy procedure, probably involving an agency to which applications may be made. For example, the applicants might be required to furnish a prospectus like that for the launching of a new public utility, including information about prospective ownership, finances, and "public necessity and convenience"; as well as something like an environmental impact statement. The governments in their turn

would be required to hold hearings on these statements, as well as to create an agency to test the applicant's statements and a commission or political process to decide on the application. Procedures can either be ad hoc, such as most of those that were followed in dealing with some recent mega-projects: the TransCanada Pipeline; the Mackenzie Pipeline; and the James Bay power development. However, when it is believed the "message" about the policy is clear and when the applicants are fairly numerous, a procedure may be formalised under a statute and given its own administrative routine, such as that available for setting up a bank under the federal Bank Act or for acquiring water rights in most provinces, even for creating an irrigation or water district.

Thus, the quest for a water-export policy can be said to be a quest for a standing government "message" to those who would put forward water-export proposals and to those who would be affected, along with a standard "procedure" to be followed by all who become involved. In the next section are to be found three kinds of message-procedure combinations among which Canadians might choose in deciding how to move from their present unpreparedness to consenting to and promulgating a policy.

B. Three Kinds of Policy Message

If Canada is to develop a water-export policy, it must publish a message. What should it say? That question must have a prior question: what should it be about? Of course if the policy is like that advocated in 1911: "no truck or trade with the Yankees", the signalling task would seem to be pretty simple. But history has shown that, even though that message was clear and triumphant, it was little more than a slogan and did not convey at all what were to be Canada's economic relations with the United States. Railways were not pulled up, shipping continued, exports and imports went on, foreign investment proceeded.

So it is with water exports. Those who oppose a permissive policy make exceptions for certain kinds of water shipment or diversion. Indeed it turns out that like the 1911 slogan, their remarks are intended to signal to the government their generally disapproving attitude to a kind of policy they imagine someone else might advocate. Their feelings could perhaps be expressed in a poem like this:

> Our running water that now flows
> Down from our lakes and springs
> Supports our trees and wildlife,

Over waterfalls it sings.

It sustains us in field and town,
It joins our regions wide.
Our Canada would not endure
Were e'er our rivers dried.

Not just another traded good
Supplied for price or fee,
Our water is our own lifeblood
And flows to keep us free.

Let those whose rivers they have stained
With wastes insulting to the eye
Whose water tables they have drained
Let them now hear our cry.

"O tempt us not with deals or wealth
Talk not of desperate need
Nor threaten us with force or stealth
Our rivers we'll not cede.

"Not if your coins to us are poured
Nor if with drought you fail
Not for your aid nor for export
No drop is up for sale!"

Such verse may signal a no-export slogan, but it is not a policy message. The message must say something about region and location, about payment and finances, and about timing, as well as drawing attention to all the benefits that would be sacrificed if water were diverted or transferred. Indeed policies could concentrate on any of three dimensions or directions, each dimension having zero exports as one possible position:

1. conditions to be met;
2. payments to be received;
3. timing or period of approval.

1. <u>What conditions for water export?</u> Along this direction are arrayed policy messages setting forth progressively less demanding conditions that must be met by an applicant following a water-export procedure. The zero position is of course that the total conditions are prohibitive and no export application can succeed. Moving away from this extreme are policy positions which set out

the total conditions to be met in a sequence which is increasingly permissive. The conditions include those to do with demonstrating that there is a water surplus at the source; that changing water levels and flows will not harm the environment; that water users will not suffer; that employment will not decline; and so forth. Thus, a permissive policy message would set forth a procedure under which applicants had only to show that there was a water surplus in the average year or (almost) all years; that environmental damage would be limited; and that producers and communities displaced by the water-diversion works would be relocated.

2. What payments for water export? Along this policy continuum are arrayed payment messages that become steadily less demanding. At the zero end the compensation requirements are prohibitive and no exports result. Progressing along this dimension the demanded compensation (or the items in the water-export activity for which compensation is exacted) is reduced. At its remote end therefore compensation has tapered off until water exporting has become essentially free and uncontrolled. To illustrate, four policy positions along this dimension might be, first, no exports; second, exports only on discriminatingly monopolistic terms whereby every scrap of advantage to the water importer is converted into cash gain to Canada; third, fair compensation only for actual cash and opportunity costs incurred by Canada; and fourth, no compensation as long as the water exporter pays for all the works along the water-diversion route.

3. What timing for water export? Along this policy continuum are arrayed policies that vary with respect to the period in which water export applications may succeed. The initial or zero position is of course that no water exports will "ever" be allowed. A less prohibitive position might be that applications, if they are ever to succeed, must be "postponed". Another position on this dimension, less onerous perhaps, would be the message that applications can "sometimes" succeed. At the permissive extreme, the policy message would be that water export proposals are welcome now and "always".

The questions asked along each of these dimensions are recognisable. In our broadcasting-licence policy, for example, the CRTC screens out applicants by a conditions procedure. The prize goes to the broadcaster proposing and accepting the most onerous conditions. The payment dimension, too, is in actual use. For example, the provinces can be said to grant permission to log in crown forests or to drill for oil on the basis of competitive stumpage or bonus bidding. Failing competitive bidding, the policy

is to set crown payments (and private compensation to farmers and others) high enough to meet the policy objectives. The timing dimension is less formally recognisable, but it is certainly in use. Some Canadian spokesmen have said that export of raw materials should "never" be allowed; Mr. Justice Berger said that the MacKenzie Valley pipeline should be "postponed" for at least ten years; various inquiries have recommended that crown resources should not be disposed of at once but spaced out over many years for sustained yield or steady revenue; and some advisors of Secretary Watt in the U.S. suggested that the public lands' resources should be sold out "immediately".

What are the advantages of selecting one of these three policy dimensions and placing Canadian water-export policy at a given position along it? They are obvious. Applicants and opponents know where they stand: there is certainty. Those who have projects can begin to plan on the basis that general policy is settled and that only the conditions, or the payments, or the timing, are a barrier to their proceeding. Similarly, those who oppose the water export will understand what it is, under a hearings or application procedure, they must show. (Of course, if the policy position is a prohibitive one, there is complete certainty for both applicants and their opponents.) Much more might be said on the advantage of this definite selection of a policy, recalling the criteria once listed as the characteristics of a good tax: yield, justice, certainty, economy in collection and compliance, etc. However, the disadvantages of this approach to water-export policy are overwhelming. If it is adhered to, it is inflexible, unrealistic, and wasteful.

As to its inflexibility, it has the fault of committing the country to a future policy stance on the basis of incomplete knowledge. For those who believe that the purpose of policy is to guide government actions so that they will add to the general benefits received from all sources, private and public, it must be recognized that new problems and new opportunities come along with time. It is unrealistic to commit one's country to a water-export policy, knowing that future events could even cause the policy, whenever it is invoked, to reduce public welfare rather than to increase it. Such events can be predicted to lead to a campaign to abandon the policy completely.

A third disadvantage of adopting a one-dimensional water-export policy is that it is wasteful. To adopt any policy there must be a prior investment in information about technology, ecology and economic and environmental preferences. Such information is

costly, as was shown by magnitude of the inquiries into the Mackenzie Valley pipeline, the Columbia River and St. Lawrence River treaty water-management projects, and the extension to Site C of the Peace River dams. (All of these projects have much in common with a typical water-export project.) The waste arises because if the specific policy investigated does not succeed, the fact-finding and attitude-shaping investments go down the drain. Furthermore, there is the waste of the misdirection of public interest, and the distraction of political energy from other governmental functions.

The costs of inflexibility, unreality and wastefulness are all real enough. It is true that they can be exaggerated, because they are not strictly additive to one another. They are three aspects of one undesirable characteristic of specific policies drafted to deal with only one dimension of water-export proposals. The lesson is that both policy and policy-making should be clear, and should also be flexible and adaptable, available for application to proposals in continually-changing circumstances. This can be accomplished, most economically, by setting-out a well-understood and robust "procedure".

The procedure, in turn, should make it possible for governments, tribunals, applicants and opponents to bring forward evidence about specific water-export proposals that is germane to a decision along any of the policy dimensions: conditions, payment, or timing. Indeed, the details of each proposal should not only be investigated as to its ecological, environmental, economic and social effects but also experimentally varied to re-define it so as to examine the most attractive combination of the three aspects that we have called the three policy dimensions.

This procedure is the comprehensive policy approval outlined in the next chapter under the heading of benefit-cost analysis.

C. Water Export Policies from an Economic Perspective

In this section are presented three brief arguments in favour of an economic approach to water-export policy.

First, it is argued that the water-export policy should be that each proposal should, broadly, be evaluated on its own merits. The reason is that the domain of possible proposals is so extensive that it would be difficult to draft a useful policy that covered all possible projects. This is because it would tend to have either of two serious defects. If on the one hand it were to

consist of a general message to cover all future proposals it would be so unspecific and empty that it would leave future government unassisted in working out particular decisions, as if the original "policy" had never been made. This would be so even if the message was completely prohibitive or completely permissive, as is perhaps illustrated by those apparently uncompromising declarations in the new Charter of Rights and Freedoms that have turned out to require laborious interpretation and adaptation, and may do so again in every generation. If on the other hand the policy conveyed to future governments and applicants all the conditions that must be satisfied by every possible water-diversion-and-sale project it would be so time-consuming and costly to develop and so inflexible in application as not to be worth attempting.

It follows that water-export policy must consist mainly of a prescribed procedure. The "message" in the policy would inform everyone about what must be taken into consideration and weighed, and who must be consulted and how their preferences are to be weighed. As a "procedure" it would consist of a set of fairly firm but general rules for those who prepared the information on each proposal, and, more important, for those entrusted with making decisions. That is what is meant here by affirming that proposals must be judged on their own merits. The rest of this section presents arguments about the nature of the procedure to be followed.

A possible objection to this kind of "policy" would be that, if every proposal were judged separately, the total, nation-wide water-export situation would be neglected. Canada might decide efficiently and fairly on every case, yet in the end wind up with too much or too little diversion and sale of water. This is a reasonable fear. It implies that the procedure must state that in each decision the authorities must take into account not only the immediate good and bad effects of the proposal if it is permitted but also the cumulative consequences of the proposed project as an addition to the total amount of water exported from that region, from that river or source, and from Canada as a whole.

Second, it is argued that the procedure must be one that is capable of weighing or balancing a variety of effects from a single proposal. This follows from the assertion underlying the previous proposition, that diversion projects will be unlike each other. The additional presumption here is that they will differ in their good effects or benefits, and in their bad effects or social costs. Furthermore, it may be argued that from a Canadian point of view

the real effects of diverting water to the United States are all undesirable. Some may be fairly tolerable, and some may be seriously disturbing. But it is hard to think of any Canadian river having levels and flows such that we would positively wish for its stages to be lowered or its volume reduced. If it were so, we might even be willing to pay the United States to drain some of our excess water away. Nothing like this has been suggested. It is true that the Great Lakes are prone to fairly regular or cyclical flooding, so that some would welcome a safety-valve, but that is not the same as saying that there is any thoughtful economic, ecological, environmental or social argument for seeking a more committed diversion of any Canadian stream.

It follows that nearly every conceivable water-export proposal will be acceptable to Canadians if and only if the importers offer compensating payment in some form. The payment may be in the form of a reciprocal water import into Canada, cash (permanent or annual), debt cancellation, lowering some barrier to trade (or migration or investment) or some other favourable American foreign-policy action.

It follows further that the "procedure" that is part of our water-export policy must be one that is capable of balancing the almost-inevitable real losses to Canada from diversion and transfer against the gains that are offered in return. Each export proposal will have its own special costs and will attract its own proffered rewards or gains. It is not unreasonable to define national advantage as a situation where the expected gains sufficiently exceed the expected costs. The point here is that the procedure for determining whether there is a national advantage must be able to weigh all the effects. That points to an economic benefit-cost analysis of the kind outlined in the next chapter.

In the third place, it is argued that the procedure must be one that is capable of "optimising" each water-export proposal before it is decided upon. The word "optimisation" here refers to a process of adjusting the design and timing of and the payments for a project until it is reconstituted in its most attractive form.[1] There are several reasons for doing this. All come down to the proposition that it makes no sense to evaluate a second-rate proposal when extra preparation would make it possible to determine whether a better variant was worth permitting.

For example, it is wasteful to study whether to direct water from point A on a river when further study would suggest a more benign environmental impact and lower construction costs if diversion were made from point B. Why would private promoters propose a less

than optimum project? They may wish to put to work some specific asset of their own: land already owned or a canal or dam already in existence. The process of project evaluation should detect this and propose the substitution of the socially better variant before a final decision is made. Another example also involves social (real) versus private costs. A promoter may argue that energy to lift water over a mountain divide is costless because the total project will generate it as a by-product. From a social point of view this would be incorrect if such energy has an alternative market. Consequently the procedure that evaluates the project should enter the energy used at its real or opportunity costs. Other examples involve timing. A promoter may be forced to propose rapid construction because of his interest costs during construction. This pace may not accord with public priorities, however, because (a) a smaller and slower project would have a more desirable impact on the local labour market and (b) the high financing costs pressing the promoter may not have the same seriousness from a social point of view (the "social rate of discount" may differ from the business rate, in either direction). This example recalls the debates between "mega-projects" and "small is beautiful". Businessmen working in the private sector are correct when they argue that the costs they perceive call for high-pressure coordinated construction activity, for high dams, wide canals, and for other sources of economies of scale. The evaluation procedure should review their plans, however, to obtain the social best from a series of projects having different social, environmental and economic effects.

To be more general, the procedure should take into account the three "dimensions" of questions that are dealt with in every policy message: the "conditions" that a project should satisfy; the benefits in the form of "payments" that it should evoke; and the "timing and duration" of the project. In optimising a project the authorities should consider these as variable and consequently as capable of being moulded and shaped to improve a proposal over its initial specifications. However, to replace such platitudinous conditions as that the project must lead to "minimum" environmental impact, "minimum" construction cost, and "minimum" social disturbance, that it must attract a "maximum" cash-or-kind-payment from the water importer, and that the projects must be installed in a present-value-maximising sequence, the policy procedure can be built around a series of calculations that enables decision-makers to understand the advantage to the total project from small adjustments along each of these dimensions.

Each small improvement along any dimension will, when the project is in near-optimum shape, cause a small loss along another dimension. For example, an improvement in the scheduling of the project may lead to a predictable environmental loss. The relationship between these small gains and losses is what is referred to technically as the "trade-off" of timing-induced gains for environmentally-oriented losses. Such trade-offs can be calculated between changes along all pairs of dimensions. Even very rough knowledge of them is of great help to those who are considering the final shape of the project to be considered for decision, in that they can put a debatable number or value to contentions heard from promoters and interest groups in favour of sweeping revisions to the plans.

To summarise, this section has attempted an orderly arrangement of the case for an economic evaluation. First, it has been argued, as it was in the preceding section, that a policy message about water exports will be valueless unless it consists mostly of terms of reference and detailed instructions for a procedure for separately judging individual export projects. Next, it was argued that the judgment of each proposal should take into account all its various kinds of effects: environmental, economic and social; and that this conclusion leads to the need for an economic framework for evaluation. Finally, it was argued that the procedure should not take proposals as they are offered, but optimise them by observing the change in overall value as experimental changes are made in their characteristics along three dimensions: physical characteristics, payments, and timing. It was urged that this optimisation process would give decision-makers "trade-off" values for judging marginal or incremental effects along one dimension as another aspect is altered.

A short name for this kind of procedure is "benefit-cost analysis". It is more rigorously applied to water exports in the next chapter.

Endnote to Chapter IV

1. Optimisation also applies when choosing the type of project needed to meet the given public goals, as well as to the optimal dimensions of a given project. This higher level of optimisation is discussed in greater detail in: Sewell et al., 1965; British Columbia Environment and Land Use Committee Secretariat, 1977; and Canada Treasury Board, 1976 (see references).

CHAPTER V. THE BENEFITS AND COSTS OF EXPORTING WATER

A. Introduction

Chapters II and III have described the administrative and physical aspects of how water could be exported from Canada. Chapter IV began the discussion of the general question of whether water should be exported. In this chapter we continue in more detail the policy-related analysis begun in Chapter IV.

The purpose of this chapter is to outline how an economist might evaluate water export proposals. A method of economic analysis is presented that allows for the identification and measurement (in dollar values) of the benefits and costs of a water export project. If an economist were asked whether a particular water export proposal should be adopted (s)he might answer that, "if Canada is on balance made better off -- that is if the benefits to Canada exceed the costs imposed on Canada when both are measured properly -- then the project should be approved."

The rationale for this type of analysis is that water in Canada is a scarce resource with many competing uses. Its scarcity gives it value, and competition among its potential uses implies that allocating water to one use (e.g. diversion to irrigate North Dakota farms) carries the cost of not having the water for other uses (e.g. irrigation for Saskatchewan farms). The following analysis of water export projects, then, is based on the general assumption that economically valuable resources should be allocated to maximize the benefits they can provide to Canada. This sentiment applies as much to the allocation of water as it does to the allocation of labour or capital.

To avoid impatience with an economic approach to export projects, the reader must understand how the word "economic" is being used here. The word is not intended to mean that only commercial or market valuations will be used. To the contrary, these valuations make up only one part of an economic appraisal. Also to be taken into account are important non-commercial values, such as those measuring losses or gains of an environmental or social nature. Examples of the latter might even include the international prestige gained from the completion of a large-scale water diversion project. If, therefore, the "economic" nature of the benefit-cost analysis of a project causes uneasiness it should not be because of its narrowness but because of its ambition. It is argued in this chapter that a comprehensive economic analysis that includes all the consequences of a water export project is the best way of organizing data and opinions for the decision-making process.

There are two very important objections to benefit-cost analysis. First, that no decision is acceptable that simply weighs gains against losses without taking into account that they may accrue to quite different groups of Canadians. This is correct. It never has been Canadian policy to presume such an intense national organic unity that it does not matter who suffers for others to gain. This objection is not specific to benefit-cost analysis, but it must certainly be accepted: being in the "national interest" does not mean that individual welfare can be ignored.

A second possible objection is simpler: that it is impossible to use economics or any other discipline to weigh different kinds of benefits and costs against each other. Some are unmeasureable and all are incommensurable. Section V.C. examines this objection in depth. At this stage it need only be commented that decision-makers must already weigh unlike effects against each other. That is their job. The claim on behalf of putting the comparison into economic terms is a modest one: that it is a good and flexible method.

B. Canadian Benefits of Exporting Water

The purpose of this section is to describe the benefits that Canadians might garner from a water export project. These include all results that can be classified as additional goods or services enjoyed as cost savings in the provision of any other goods or services or both. More precisely the potential gains from a water export project may include: payments to Canada for the water it has exported; increased employment during the construction phase of the project; indirect cost savings made possible by the installation of the water export project; recreational gains; and political benefits. Each of these will be discussed in turn.

The largest potential benefit is likely to be the payment(s) Canada will receive for its exported water. Payment may be expected to be based on the volume of water transported and may also reflect the seasonality of the water's value. If payments are received over the lifetime of the project (rather than as one lump sum payment at its inception), then to compare this benefit with various initial costs future payments must be converted into "present dollar values." This is a straight-forward operation but it involves choosing an appropriate discount rate and making appropriate allowance for future changes in the domestic foreign value of the dollar.

In addition, the successful completion of a water export project may lead to political gains for the government(s) of Canada. These could include both the increased goodwill and cooperation from foreign governments and the associated achievement of federal and provincial policy goals made possible by the project. Examples of the latter might include assistance for regional development projects and decreased reliance on exhaustion fossil fuels.

Another potentially significant benefit may stem from increased employment during the construction phase of the water export project. If the project construction draws labour (or other factors of production) from demonstrably less productive uses (especially if the project were undertaken in a region of chronic underemployment), then the value of the increase in employment can justifiably be included as a benefit.

Cost savings in Canada made possible by a new water export project may also be included among its benefits. Let us consider how these might come about. A scheme to transport water to the United States is likely to have substantial effects upon the water supply patterns in the adjacent Canadian regions. It may be possible for those regions to benefit from the water exports to America. For example, local water supply may be made more reliable or less expensive if the water export works are designed to serve Canadians as well. Alternatively, local flood control may be made less costly by a water diversion project.

There are other potentially significant benefits stemming from water export projects. These projects may create new recreational opportunities. For example, a water diversion project may lead to the creation of a lake attractive for recreational boating. Such a benefit is real enough though hard to measure. It is approximated by public willingness to pay for its use.

These are the benefits which might be expected to arise from a water export project. Before turning to the costs of such a

project two important and often controversial aspects of any benefit-side calculations warrant discussion. These are the "income redistributional" effects of a water export project and the problem of uncertainty in the measurement of the benefits (and costs) of a water export project.

Usually, the redistributional effects on incomes of a water export project are not incorporated into a cost-benefit study because they reflect nothing more than dollar-for-dollar transfers between Canadians. The gains to some are exactly balanced by the losses of others. How to treat them is given considerable space in the official Canada Treasury Board Benefit-Cost Analysis Guide (1976, ch. 2). The general rule is that such redistributions should be considered as a benefit (cost) only to the extent that they also influence the allocation of resources or that they reflect the achievement (failure) of governmental policies. For example, a water export project might inadvertently bring larger federal compensation payments to a region than the foreign payments received in Ottawa. Thus, the project would effect a general income and welfare transfer to the region from the rest of Canada. Whether this inter-regional transfer should be treated as a benefit of the project is a question to be answered by reference to political policy. If it helps to achieve what Parliament would attempt to bring about in any case some fraction of it may be counted as among the project's benefits to Canada as a whole. Of course, to the favoured region all the transfer may be treated as a benefit.

Finally, it is more than likely that future benefits occuring from the water export project will be known imperfectly or at least that there will be uncertainty regarding their magnitude. These informational problems could arise from uncertainty about future forecasts of American demand for our water or if the future supply-demand balance of Canadian water is not well understood. Cost-benefit analysis can usually be extended to allow for these considerations. By considering the probability of alternative future water scenarios and finding the weighted average of future benefits from these separate scenarios, cost-benefit analysis can aid decision-making in the face of uncertain or imperfect information.

C. Canadian Costs of Exporting Water

In section B we discussed the benefits that might be generated by a water export project. Carrying out such a project, however, will not be without its costs, against which the benefits must be assessed. In general terms these costs are the value of the real resources to be employed in the project displaced from other uses in the economy. The purpose of this section is to identify those resources and discuss how they are valued.

The main cost component of a water export project will probably be for construction of the water transportation facility. As mentioned in Chapter II, diversion canals, dams, levees and other works will be needed. In the United States, water diversion projects moving water across flat desert areas have had annualized capital cost projections of $\$60/1000m^3$ per year for a 600 km pipeline (Howe and Easter, 1971:110). As most of the capital costs must be incurred before operation can begin there may be a considerable accumulation of interest costs during the construction period and early life of the project. The reason for including interest charges with the direct cost of capital is that interest charges are a measure of the annual return to the economy as a whole that the capital employed in the project could have earned in profitable opportunities elsewhere.

Operating expenditures (including pumping costs) and maintenance costs must be added to the project's annualized capital costs. Once operation has begun we might expect these to be more or less constant. A major part of O & M costs will be the project's annual wage bill. The extent to which the cost of labour is included as a cost of the project will depend on the state of employment locally. If labour (or another resource) is employed during the life of the project which would not have been employed otherwise, then in an economic sense the cost of its use is zero for nothing is foregone in using its services on the project. A more likely scenario, however, is that labour is only to a degree underemployed. Some workers may have had jobs at least part of the time. Also, even in a region with high unemployment some of the workers hired must be drawn from a labour market of skilled, experienced employees with good alternative employment opportunities. The extent to which labour costs may be "marked down" is often a difficult and controversial topic in cost benefit analysis (Canada Treasury Board, 1976, ch. 2).

A second major component of operating and maintenance costs will stem from the energy required to pump water. Because of the substantial increases in energy costs during the 1970's and 1980's and because of the mountainous topography of much of western North America, the costs of pumping and raising water may be quite significant (see Christensen et al., 1982).

While the other resources used in a water export project will usually be valued at something close to their market prices, there may be instances when their cost to the project may have to be corrected by imputation. For example, if publicly-owned land is used in the construction of a water diversion canal, then no market transaction may occur to reflect the value of its use. Yet that area may have valuable alternate uses (as farm land or park land,

for example). In this situation a value must be imputed to the land for the purpose of measuring the full costs of the project.

Perhaps a more important example concerns the benefits we will forego by having less water available to Canada (in either a stock or flow sense) as a result of water exports. If water is to be sold or exported to the United States and if that water could have been used in Canada, then we must net out from the project benefits the value of its use had it remained in Canada. This value would stem from its use in irrigation, industrial, recreational or domestic consumption. We will refer to this value as the "opportunity cost" of exporting water. Values from the sheer presence of the water in Canada are included with environmental costs below.

A potentially significant but often neglected cost is that of decommissioning the project. Dams and canals have finite lifetimes. In many cases at the end of the project's lifetime some amount of returning the project site to its original state will be carried out (for example, through tearing down capital structures, landscaping and reforestation). For some large public projects these costs can be expected to be substantial. Like construction, operating and maintenance costs, the calculation of decommissioning costs will depend on the time pattern of expenditures and will require the choice of an appropriate discount rate to convert remote future expected costs into current dollar values. As most water developments have been relatively recent, we have little experience with either the process or the costs of decommissioning dams and canals.

The final set of water export-related costs stem from the potential impact of the water export project on the natural environment. We have already insisted that both land and water used in the project should be costed at at least the value of their best alternative use. In addition to the removal of land, the project may cause environmental degradation during its construction or operation phases. Examples of this type of impact, mentioned in Chapter II, would include the following: lowered river levels causing higher mortality among fish populations; stream diversions leading to decreased wildlife habitats; and accelerated rates of stream erosion. Although these effects are difficult to identify and quantify, any environmental damage from a water export project should be somehow recognized in the cost-benefit analysis.

There are three ways of handling the difficulty that human valuations of hydrological and ecological changes are rarely stated in money terms. One way is to attempt direct estimates, emulating market valuations; a second is to measure the cost of

mitigations and compensations payable to those who suffer from the changes minus the gains to those who benefit; while a third is to abandon the measurement attempt and treat environmental damage as a physical and subjective concept to be valued as a residual in benefit-cost calculations. Each of these is touched on below.

Direct Estimates. There are well-known techniques available for estimating parts of the environmental damage sustained when water quality is changed. Peter Victor, for example, is the author of studies of the value of fisheries damaged by acid rain in Ontario; estimates like his have been made in several regions (Dewees et al., 1975). Other studies, including one by Peter Pearse, made earlier estimates of the damage stemming from mercury released into the Great Lake basin. Some of these techniques are applicable to changes in water flows. Another set of studies have accumulated over the years demonstrating the possibility of measuring the human valuations of changed water levels. The best examples are, once again, those made for the Great Lakes, usually for I.J.C. references. In other sources (I.J.C., 1976) attempts are made to value the effects of lake-level changes on fisheries. Another source of estimates is the damages sought or awarded in legal cases. The Alberta action brought by the Town of Peace River against B.C. Hydro concerning the change in the regime of the Peace River due to the Bennett Dam is especially useful here because the alleged damage was part of a more extensive change in river-basin ecology. In the Garrison Dam and Poplar River dockets of the I.J.C., too, will be found testimony concerning the damage from ecological changes. Some of these imply orders of magnitude in the minds of the speakers or writers. Another approach is in its infancy: bidding games by recreational users or outsiders (see Kneese and Brown, 1981:170-8).

Mitigation and Compensation. Some of the more serious environmental effects of construction can be reduced or prevented altogether by adding other features to the diversion works. The expenditure necessary to mitigate the damage is then used as a proxy for a measurement of the environmental cost. Examples and discussions are to be found in the Berger Report (1977) the Site C Report of the B.C. Utility Commission (1984), and the I.J.C.'s Garrison Report (I.J.C., 1977). Most of these have to do with environmental quality; however, the I.J.C.'s Poplar River report also deals with the amount of water needed for power-plant cooling and waste-heat disposal. There is a very large literature on the costs of environmental mitigation, especially reclamation and rehabilitation of open-pit coal imines (Kneese and Brown, 1981).

A good example associated with water transfers is to be found in the High Plains report. The authors devote a long chapter to the environmental impact of the four alternative canal projects,

and include a methodology for estimating mitigation costs. For the one canal to which the estimating procedure was applied, mitigation costs averaged about 5 to 6 percent of expected capital costs. One such cost would be acquisition and improvement of wildlife habitat lands to compensate for other habitat losses.

Closely related to mitigation costs are those arising from the acquisition of information about environmental impacts by attenuation and monitoring. At several places in this study we have mentioned the opportunity to slow down construction work and space out its components over an extended period. Such attenuation permits decision-makers to learn at first hand how projects may hurt or enhance their natural surroundings. A closely-related idea is monitoring. As Keith Henry, the chairman of the major Site C hearings, commented, ". . . many decisions might be delayed if an adequate system of monitoring impacts were to be set up, including a method of making sure that impacts so measured would be mitigated or compensated for. This solution would allow an opportunity to see what really does happen and provide specific remedies" (Henry, 1983:75). This approach is costly, though not necessarily more so than any alternative. Building smaller versions of eventual works produces information without much damage, but it also misses the technical economies of scale of full-sized works. The waiting time before full operation is likely to be considerably longer and so more costly to finance. Monitoring itself is difficult to organize and expensive. Furthermore, if it is successful in detecting serious environmental harm it points to further costly mitigating works, compensation, removal or indeed abandonment of the whole project. But this is the point: it may be less costly to go ahead and experience bad impacts than to delay and study them using too little data. Jane Austen's character, Charlotte Lucas, put well the unprofitability of some advance measures of study and mitigation:

> "I wish Jane success with all my heart; and if she were married to him tomorrow, I should think she had as good a chance of happiness, as if she were to be studying his character for a twelve-month" (Pride and Prejudice, Ch. 6).

When there is little information to be pondered, environmental harmony and matrimony are both matters of chance, as Charlotte later observes. It follows that the extra costs of keeping components small, building slowly, studying new effects (monitoring), and being receptive to using the project itself as a study device may be the least wasteful of the components building up the environmental cost category.

Residual valuation. The methods above may fail. There may not be enough scientific information about citizens' valuations of

the changes in the environment brought about by a water export project. If not, politicians and their assistants must do without scientific investigations. Then under the third method, benefit-cost analysis expression must be stood on its head. The question whether a project's benefits are greater than its construction costs plus water opportunity costs plus environmental costs must be restated, and becomes the question whether its (perceived or feared) net environmental effects (costs) are serious enough to exceed its expected net benefits (that is, benefits minus construction costs and water opportunity costs). This "is it worth it?" approach to estimating an amount has been used in some actual environmental studies. Here it side-steps the dollar measurement problem by putting the emphasis on a comparison of total benefits (net of construction and water opportunity costs) with what is objectively known and subjectively felt about what would happen to the environment at the source and along the course. The burden of estimation, in other words, is placed more heavily on benefits. Knowledge of how much the promoter is willing to pay helps the resource owners to think through not only how much the water is worth but more important how much the consequent net damage to the environment is worth.

How should a decision be reached, once both benefits and costs have been estimated? The basic idea is to make sure that the present value of benefits exceed costs. The precise details of this general "criterion" are a subject for debate: for a review of alternative criteria and their respective pros and cons, see the Treasury Board's 1976 Benefit-Cost Analysis Guide, pp. 26-32. The most commonly employed criterion states that if the benefits exceed the costs then completion of the project will contribute to the wealth of Canada and, as a result, the project should be undertaken.

There are situations when this decision-making rule should be modified. The presence of uncertainty regarding important costs and benefits requires that we compare the expected present value of benefits and costs. This procedure was discussed in section B.

Alternatively, the project may involve making decisions which are in some way irreversible. For example, a water export project may become so much a part of the way of life of the importing region that it would be politically or diplomatically unthinkable to end it. Or, a river diversion (with its attendant impacts on agricultural and industrial development) may be treated as irreversible if the diversion can be undone only at a prohibitive cost. In such situations economic analysis calls for modification of the benefit-cost decision rule. It has been shown that adding a

sum of the value of the foregone environmental asset will prevent over-investment in irreversible projects. The needed sum has been called an "option value" and can be thought of as an insurance premium paid to make sure that the asset (or equivalent compensation) is available if and when wanted (see Dasgupta and Head, 1976:397-400). Of course as taking out insurance does not prevent a fire, so adding an option value to a project's costs does nothing real to increase the probability of the project's reversibility. That must be part of the project's optimisation, referred to elsewhere.

D. Some Illustrative Calculations

The preceding sections have outlined the major issues pertaining to the measurement of the costs and benefits of a water export project. The purpose of this section is to present some calculations drawing on evidence from past water transfer projects and current proposals. This task should give some clarity to our theoretical discussion and should provide some feeling for the "ball-park" in which cost and benefit figures rest. Unfortunately the available information is sparse.

We need to know how much Canadians and Americans are willing to pay for various amounts of fresh water. The key parameter for this data is the "elasticity of demand", stating how much consumption would fall if the per-litre water charge increased slightly. Almost as important is the elasticity of substitution, a statistic revealing the relative importance of water compared to other inputs in farming and other water-intensive activities. Thirdly we ought to know the cost economies of scale with respect to volume and distance for water canal and pipeline construction. There may be several reasons for this paucity of information. Perhaps most important, until recently the perceived abundance of water in Canada (and to a lesser extent, the lavish subsidisation of water in the United States) has stifled econometric research. Furthermore, the topographical conditions among water diversion routes may have differed enough to make generalizations regarding project costs difficult or uninformative.

Despite these problems, some ball park figures relevant to the study of a Canadian water export proposal can be estimated. We first consider estimates of capital costs of past water diversion projects.

Howe and Easter (1971:107-111) report amortized capital cost figures for several proposed and operational water diversion

projects in the western United States. These costs (converted to 1984 dollars) range from \$70/1000 m^3-year for a Colorado-based project designed to transport 9 billion m^3/year over a distance of 500 kilometers to \$250/1000 m^3-year for a complex scheme to divert 2 billion m^3/year in the American South-West over 1500 kilometers. These figures are based on a 5% discount rate and an assumed project lifetime of 50 years. More recent capital cost estimates are available from Wallace et al. (1982:201). Their results are presented as Table V.1, showing how capital costs rise as the amount of water to be pumped and transferred increases. The numbers are drawn from seventeen actual and proposed California projects to bring water various distances from outside the state, for, say, at least 300 km.

Table V.1 - Costs of Water Transfer in California

Annual Yield or Delivery (billion m^3/year)	Amortized Capital Cost (1980 \$/1000 m^3 yield)
0	30
1	35
2	40
3	45
4	60
5	80
6	120
7	150
8	250-300

Source: Wallace et al., 1982:201.

The most important thing to notice from the table is that in order to increase the annual yield of water diverted into California, the water authorities there would find capital cost increasing at an increasing rate. (This finding about short-distance transfer) is particularly relevant for Canada for it suggests that with ever increasing American (and particularly Californian) water demand, water importation from Canada will become more and more attractive. Such numbers are consistent with Rogers' (1984) discussion of the Auburn Dam project. He suggests that construction costs of irrigation water from the neighbouring Sierra foothills cost Californians over \$50 (US) per 1000 m^3.

Comprehensive economic studies of proposed or existing water diversion projects within Canada are scarce. Those available are usually engineering cost estimates; that is, the cost of a particular design approved on engineering or geological grounds. Consequently, unlike the table above, they convey little about the relationship between project scale and construction costs. As well, engineering evaluations usually do not incorporate measures of implicit costs such as the opportunity costs of water and land or the costs of environmental degradation. Nonetheless these studies carefully delineate capital and operating costs and are therefore valuable for the discussion of the feasibility of Canadian water exports.

One such engineering cost study was undertaken by the Saskatchewan-Nelson Basin Board (SNBB, 1972). This considered several possible water diversion projects in the southern Canadian prairie provinces. For our purposes a particularly interesting proposal concerns the diversion of water from the South Saskatchewan River through the Qu'Appelle River north of Regina, southward to the Souris River in the south-eastern corner of Saskatchewan. We choose this example because it transfers water from an "all Canadian" river to one that flows into the United States. The project would have the capacity to divert some one billion m^3/year of water over the 300 kilometer distance. A detailed cost breakdown is illuminating and is provided below.

Table V.2 - Qu'Appelle River Diversion

Item[1]	Cost (million 1984$)[3]
1. Channel Improvements	
- Qu'Appelle Dam to Buffalo Pound Lake	42.0
- Buffalo Pound Lake to Craven Control Station	56.7
2. Lake Control Structures (two)	0.75
3. Craven Pumping Plant	56.0
4. Canal: Craven to Rafferty	210.0
5. Boggy Creek Dam & Reservoir	1.8
6. Wascona Diversion Canal	1.5
7. Sidley Dam and Reservoir	2.8
8. Moose Jaw Creek Diversion Canal	8.3
9. Rafferty Dam and Reservoir	18.4
Total	398.2
Annual Cost (approximate)[3]	36

Source: SNBB, 1972, app. 3, pp. 84,92.

Spread over the intended billion cubic meters per year the construction cost of $36 million per year comes to $36/1000 m^3/year at 1984 prices. This unit cost lies in the same order of magnitude as the Auburn project mentioned above. Although this considerably less than the $200-400/1000 m^3 per year for the four alternative High Plains projects studied in 1979 by the U.S. Corp. of Engineers, these projects differ so drastically from Canadian plains conditions that comparisons may not be useful. Whereas the Canadian SNBB project involves lifting water out of the Qu'Appelle water course into another until the Souris River is reached at a lower altitude, the American projects would transfer water abut the same distance uphill most of the way until the High Plains area is reached, in some places 1200 feet above sea level. Installation of dams and pumps to make this possible would account for much of their higher cost. In any case, the SNBB study suggests an initial cost in Canada, for construction only, of approximately $400 million in 1984 prices.

To this capital cost must be added the opportunity cost of the water and the environmental costs. The main opportunity cost is the alternative use of the water for irrigation. Its value can be approximated from the contribution of this flow to agricultural output at the source, the Qu'Appelle River basin. This now has approximately 7800 hectares of irrigated farmland (PPWB, 1982, app. 3, p. 75-76). Assume that the value of output of this land is about the same as irrigated land in Alberta -- about $700 per hectare (1984$) (adapted from Goedhart, 1984). If diverting water from the Qu'Appelle totally eliminated irrigated lands in the subbasin, these figures suggest that the opportunity cost would be roughly (6/1000 m^3 per year (1984).

This may be determined to be the basic opportunity cost of the water, to be added to the $36/1000 m^3 per year construction cost previously estimated, which suggests that works and water together would cost any exporter about $42/1000 m^3 per year.

Even before we consider the environmental costs, we must pause to ask if we have found the right value for the water. Some of it, if not exported, would be used for urban and industrial purposes. If municipalities had to develop new supplies of water to replace the exported water, this would be another type of opportunity cost. Gysi (1981) indicates that present urban water rates are about $0.25/1000 m^3 (p. 50) and that, in Calgary, the cost of adding new capacity (through a new water treatment plant) to the system is

about 10 times as much (p. 48), or about $2.50/1000 m^3. As it would likely cost even more to bring in entirely new supplies (and treat that water), the $6/1000 m^3 opportunity cost may be as much as $10/1000 m^3 too low. If so, the combined cost of works and water may be closer to $52/1000 m^3.

A second question is whether the calculated yearly irrigation value today is representative of future years. There are two general but conflicting trends here. On the one hand it may well be that for economic and climatic reasons land cultivation will be moving north within North America. If this happens, the value of water for irrigation in the Alberta-Saskatchewan region will increase so that water exports will impose a future opportunity cost larger than today's.[4] On the other hand, there are forces at work to reduce the need for water. The frontier of cultivation on the Canadian plains is no longer expanding, and the water needs should also decline. Furthermore, it is to be expected that other imputs can increasingly be substituted for water, should it become more valuable. Intensive research is necessary therefore, before we may judge whether our $50-55 cost estimate so far is high or low.[5]

The final category of costs are the environmental costs. The three techniques outlined in section V.C above can be used to estimate these costs. For example, Decooke et al. (1984) make a direct estimate of the economic effects of a 10,000 cfs (285 m^3/s) withdrawal from Lake Superior, as summarized in Table V.3 below. The $87 million/year cost would be incurred in the annual diversion of 10,000 cfs (285 m^3/s). This works out to be about 9 billion m^3 per year, and gives an environmental cost from these three effects of about $10/1000 m^3 per year. Although this number may not be directly applicable to the Qu'Appelle example, we will use it as a rough "order-of-magnitude" approximation. This suggests that a figure of, say, $15/1000 m^3/year to represent other aesthetic and biotic environmental costs is not out of line, again as an indicator of the possible order of magnitude of actual costs.

Benefits. Earlier in this study we observed that it is not completely clear who in Canada has the right to the various aspects of flowing and standing water. The owner of the rights is the party who ultimately suffers loss if the water is diverted away, for it has the right to consume its services, give them away, leave them unharvested, or sell them. When we speak of water exports we speak of sale. The owner(s) can be assumed to be entitled to the

Table V.3 - Economic benefits or costs of 10,000 CFS (285 m^3/s) withdrawal from Lake Superior

(Effects are in both Canada and the U.S. in 1979 U.S.$.)

	Millions per year
Shore property valuations	$ + 11.0
Lake Navigation values	- 20.0
Hydro power values	- 78.0
TOTAL EFFECT	$ - 87.0

Source: Decooke et al., 1984:13.

proceeds of the sale, whether in kind or cash. We shall refer to these proceeds as payments or "benefits".

How much are Americans willing to pay? Let us consider a significant block of water, one billion m^3 per year, carried from Northern Ontario/Quebec or the valley of the North Saskatchewan River to, say, Colorado. An agreement is made dealing with the seasonality and steadiness of flows, storage, quality, short-run interrupibility with or without notice or compensation, and long-run revocability of the whole agreement with or without compensation. Although each of these aspects of the deal affects its value, we must cut through these details here to ask about what the Americans would be willing to pay.

Immediately we ask this we run into another conceptual problem. Who are the Americans? As we have seen, little or no irrigation water is distributed in the U.S. (or Canada) at its cost. The information problem is far worse than that confronting North American energy demand analysts in the early 1960s. It seemed then that no important fuel was being sold at its true cost -- instead regulatory regimes had rationed oil import permits, held down gas prices, subsidised hydro electricity and distorted coal transport charges. Using some ingenuity however, it was possible for experts to calculate what American industry and consumers were willing to pay for increased supplies of gas, oil, coal and electricity. Our reading of the water literature suggests that these experts will have a far more difficult time deciding what, if

available U.S. water were sold in a water market, farmers and industry would in equilibrium be willing to pay. As Bain et al., (1967) showed, even the state of California with its network of intersecting and connecting canals and laterals has nothing that could be called a water market. This is the state where appropriative, transferable, water rights originated!

The following table drawn from various sources shows what some American water users were estimated to gain from marginal acre-feet and m^3 supplied in the 1960s:

Table V.4 - Summary of Direct Benefits per Acre-foot and 1000 m^3 at the Margin of Application

[Marginal direct benefit per acre/foot]

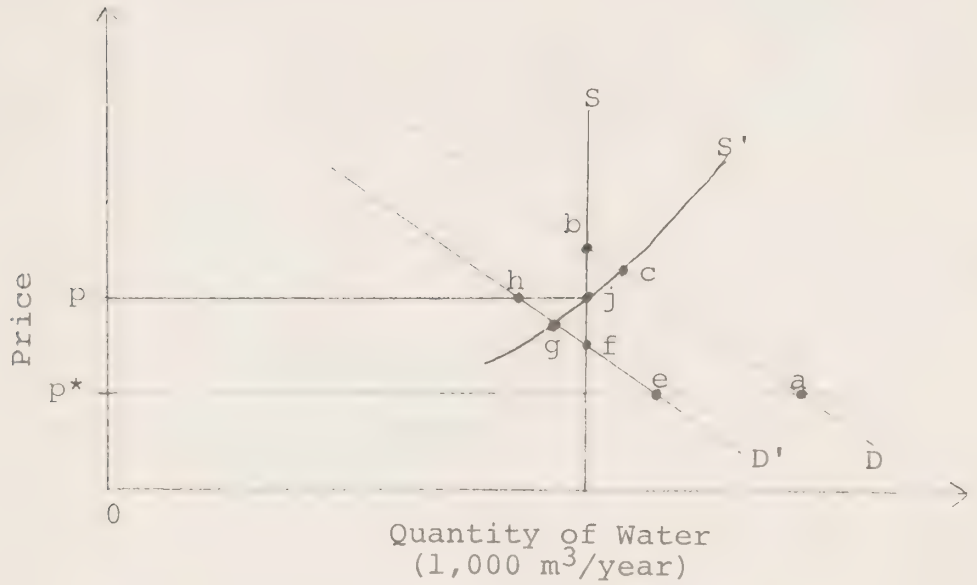
Area		1984$ per/acre-foot	1984$ per 1000m^3
California		52	46
Colorado		9-24	7-19
Arizona	Central (short run)	63	51
	Central (long run)	39	32
	Pinal county	27	22
Texas	High plains (1970)	81	66
	High plains (1990)	108	88
Utah		36-45	29-36

Source: Howe and Easter, 1971, pp. 38-48 esp. Table 11 p. 47. All studies were made in the late 1960s.

Other data are in the same range, let us say $100 (Cdn.) per 1000 m^3. But this is almost certainly an overestimation of the value of water, since farm prices are supported and the water already in use is subsidised. If the farmers and other users had to pay the full construction, financial and opportunity costs of their water, the amounts already taken would fall.

Figure V.1

The Demand for Water



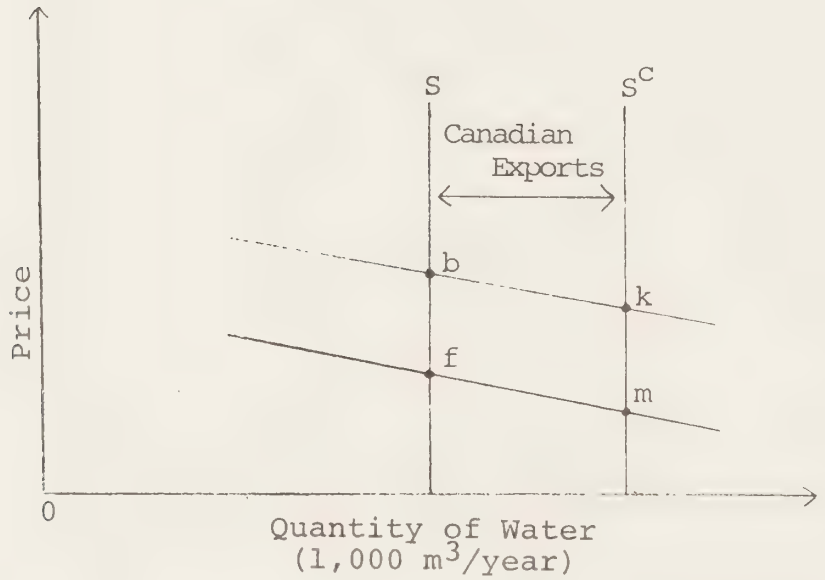
Consider the illustrative supply and demand curves in Figure V.1 above. S is the amount of water supplied to an irrigation district by an existing system. p is the hypothetical water price that would pay for the supply system and the opportunity cost of the water. p^* is the actual subsidised amount paid by water users (Howe and Easter, 1971, ch. 3). With farm products at protected and supported prices, the derived demand curve for water is D. Farmers would like to consume amount a but only S is available. Hence the marginal demand price, such as that reported by Howe and Easter, is as high as b. If all users were charged b, water would be diverted from other American users and the supply system would be expanded to S'. The relevant marginal demand price for water transported from long distances would then be higher than j, the existing cost of water supplies, but less than b, the reported marginal demand price.

Even this may be an overestimate. If the price supports and protection for foods and fibres produced under irrigation were removed, the demand curve would slip down to D'. With existing supplies, the stated marginal demand price would be f. If this is less than p, as shown, an abandonment of subsidies on water supplies would eventually return the water demand price to the neighbourhood of g (or h or j, depending on whether the local

system is expanded or contracted in the long run). These are all lower than b, which is therefore still to be considered an over-estimate of the marginal demand for water carried from Canada.

Figure V.2

Effect of Canadian Exports



This would be estimated at k in Figure V.2 if the U.S. continued to protect and subsidise agricultural food production, but as low as m if this farm programme were withdrawn or scaled down. The free market demand price delivered to the local district might therefore be as low as $75 (Cdn.), far too little to cover the $200-$800 transport costs from Canadian rivers or lakes. (This estimate of transport costs is based in part on figures in the U.S. Corp. of Engineers' 1982 High Plains study.)

Unfortunately, all this analysis does not serve to predict what the U.S. government will be willing to pay. It would be folly to assume that American governmemts will suddenly cease to attempt to provide water for the farm and semi-rural regions in the south-western states. It is true that the present Reagan administration has not encouraged spending on large-scale water impoundment and transfers, and this may reflect a new hostility by voters to the

water projects that have played such a role in American politics since the Great War. On the other hand, the Garrison Dam project continues to obtain some Congressional support, and there is no move to stop further investigation of the High Plains project. On balance, Canada should assume that the U.S. thirst for dramatic reclamation and irrigation projects is still unsatisfied and that in the future the states and federal government will resume their quest for new supplies. This seems even better advice if future climatic change reduces U.S. precipitation.

The government's or official offer price may therefore be much higher than the individual marginal demand prices discussed above. An American government that will contemplate $600/acre-foot per year (about $640/1000 m^3 per year) to bring some of the existing flows from the Mississippi-Missouri system to the High Plains might readily agree to pay $200/1000 m^3 at the Canadian border to firm up this flow and avoid taking water from existing U.S. users. However, if the Canadian water price to cover diversion in Canada and opportunity costs in Canada were in the $50-$100/1000 m^3 per year range and if it were added to the U.S. transportation cost of $600, the resulting delivered cost would be so high that it is difficult to imagine that U.S. governments would be able to justify the necessary water subsidy (running into the billions of dollars).

A tentative conclusion therefore is that the U.S. government might offer Canada over $100/1000 m^3 per year if the water is available in large amounts from locations where pumping near the border would not be a serious cost. American price offers may even exceed that level to the extent that:
(a) the Canadian supplies are available at a high altitude or in the west (to reduce U.S. transfer costs);
(b) Canada is willing to export large volumes (to reap economies of scale in canal building); and
(c) alternatively to (b), Canadian supplies are marginal to new large U.S. diversions to the southwestern states (to obtain a premium for firming up fluctuating supplies already paying for new diversion works).

The price paid per unit would not be the only source of benefit from Canadian water exports. For instance, water diversion that lowers regional water flows in Canada may also serve to regulate water levels and flows and thus lower the frequency of flooding during peak-flow seasons. We have seen that the stabilization of Great Lakes levels would bring benefits to the owners of shoreline properties. Less well studied, in the Qu'Appelle River diversion project the installation of four dams and reservoirs is

expected to moderate changes in river levels. If the value of crops in the areas subject to flooding and the change in the probability of flooding were known, a dollar value of the benefits from the reduced likelihood of flooding could be estimated (for a more detailed example, see Canada Treasury Board, 1976:56-62).

The final category of benefits stems from the likelihood that the construction of a water export project will provide employment for some otherwise underemployed factors of production. Little can be said now regarding the magnitude of this class of benefits without knowing the particulars of the project proposal, its timing and the regional economic context in which it was to be undertaken.

E. Concluding Remarks

To pull together the discussion in the previous sections, Table V-5 is presented. The derivation of some of the numbers has been discussed in the text, but several are purely hypothetical to illustrate the benefit-cost calculation and to suggest the order of magnitude they have in the author's imagination.

Table V-5 - Illustrative Summary: Costs and Benefits of Export of 1 Billion m^3 per year[6]

(1984 $ per 1000 m^3)

Benefits		Costs	
Payments from U.S. (no transportation)	100	Diversion, transport pumping, operation & maintenance	$36
Incidental real Canadian benefits	25	Water opportunity cost	6
		Environmental costs	
		Great Lakes items	10
		Aesthetic and biota	15
Total benefits	$125		$67

Source: see text.

To take the benefits in turn, the U.S. payment number is derived from the text. Incidental benefits to Canada are undoubtedly small and include regional employment benefits as well as possible benefits from reducing river fluctuations and providing irrigation water en route. Further research on the costs of moving Canadian water to U.S. dry areas may put the final benefit total anywhere between zero and $420.

The costs to Canada are even more uncertain. The $52/1000 m^3 figure is considerably below the probable construction and maintenance expense of the best-known modern project, the GRAND diversion, which passes through rocky country and involves a good deal of pumping. It may however, be closer to the cost of a great plains diversion. The present opportunity cost of water in Canada is small, although none of the authors who have discussed the deceptiveness of this belief have put a number to support their discussion. We suggest $6 for the great plains. We recognise that our estimates for environmental costs are even more unsubstantiated. The first figure (for the Great Lakes) is taken from Decooke et al., (1984) and consists mainly of the effects on power production of a change in lake level. The second figure labelled aesthetic and biota is not based on any research or investigation. A good check would be to discover whether it is compatible with the sum for which the James Bay natives sold some of their right to object to present diversions in northern Quebec. If acceptable calculations of environmental damage cannot be made, the procedure must depend on the "residual" method mentioned earlier in the chapter.

We hope that our foray into illustration will bear fruit by provoking others to supply better estimates of the elements of a representative water export calculation. The purpose here however, is almost entirely illustrative. It is argued in Chapter IV that a good water export policy for Canada would be built around a benefit-cost analysis of particular proposals. This chapter has suggested the possibilities and difficulties of undertaking this kind of economic evaluation.

There is no denying the difficulties. The chief advantage is that it provides a method of giving weight to each of the great variety of factors that must be taken into account in making a decision on concrete proposals. For example it gives those who feel strongly about the environmental (and especially aesthetic) costs of any water diversion or transfer the opportunity to suggest numerically the strength of their feeling. Citizens do this implicitly, all the time. In their private lives they must decide

how much to spend on the appearance of their home and its furnishings, apart from the costs of simply keeping out the weather. In their public lives they support or oppose various politicians who make even more complex choices about expenditures on the environment, music and art as against spending on pubic works, social services, defence and R&D. These choices are made routinely and they obtain the consent of the voters. An economic analysis of the kind illustrated here merely makes explicit and numerical the choices, the weights and the values.

Endnotes for Chapter V

1. A detailed discussion of the nature of the project and its components can be found in SNBB (1972) Appendix 3, p. 84-85 and 92-93.

2. The Qu'Appelle project was designed in 1970. The cost of items 1), 3) and 4), originally expressed in 1970 dollars, has been updated to 1984 dollars using the engineering cost estimates in the six-state High Plains study (1982, Appendix E, Figure 22 and 24). The original cost estimates for the other items found in SNBB (1972) were simply updated using Non Residential Building Construction Input Price Index, (Statistics Canada Cat. No. 62-007).

3. Annual costs were computed by adding discounted annualized capital costs (including depreciation to estimated discounted annual operating and maintenance costs (see SNBB, 1972, Appendix 2, pp. 125-130 for details).

4. For example, David K. Elton (1982) and Canada West Foundation (1982) forecast a doubling of prairie irrigation by the end of the century. This optimistic forecast requires far less water than if "maximum use of available water" were undertaken, and still less than if all irrigable land were supplied with water transferred from other river basis. Elton summarises official and Canada West Foundation "demand" forecasts in "Managing the Water Resources of the Prairies" in Water Policy for Western Canada; by "demand" he appears to mean political demands by Alberta farmers for water at present (subsidised) prices. See also Canada West Foundation (1982 p. xxv).

5. See Canada West Foundation (1982) for the downward revisions of irrigation water withdrawals from Lake Diefenbaker. See also Veeman (1984); this is one of the few water studies that takes value or cost into consideration.

6. Most of the numbers shown are purely illustrative. Particular caution must be adopted in considering the environmental damage figure, which is given in relation to the diverted flow which causes it. Many experts would probably object that most of the harm or insult arises from the initial diversion, and is not closely linked to the number of cubic meters diverted. This argument may suggest that the benefit-cost analysis would be better shown in annual total terms. In that case the annual total of benefits would be of the order of $12 million per year. We are

then challenged to decide whether the predicted environmental effects would be more or less than, say $6 million per year, the amount necessary for total costs to exceed $12 million in expected benefits.

CHAPTER VI. ORGANIZATION AND MACHINERY

The two preceding chapters have proposed an economic framework for evaluating individual water export proposals. This chapter examines possible organizational arrangements that could be used to implement our proposed procedure.

A. Administration of Existing Diversions and Apportionments

The purpose of this section is to describe briefly the existing administrative arrangements for permitting, setting up and controlling some Canadian and international (Canada-U.S.) water diversions and apportionments. These are important to our study, not because we are reporting on stream regulation, but because of the precedents they give for intergovernmental arrangements for coordination of water use.

1. The Columbia Treaty System

The sinuous Columbia-Kootenay system has been harnessed since the turn of the century by an increasing number of hydro-electric dams and reservoirs in Canada. As the Columbia River is part of an international drainage, both Canada and the United States are restricted by the Boundary Waters Treaty of 1909 in the extent to which they can construct works that raise water levels in the other country. The 1955 International Rivers Improvement Act allows the federal government to regulate provincial or private international diversions, by providing a licensing procedure.

The two nations entered into the Columbia River Treaty in 1964. In it Canada and the U.S. agreed not to make any diversion of the (regulated) natural flow of the Columbia-Kootenay waters for 20 years (until 1984); after that to make limited diversions within the Columbia basin. The Treaty involved Canada, the United States government, the British Columbia government, B.C. Hydro and the Bonneville Power Administration. Day-to-day management governing upstream water releases and related power and energy transmission questions is by the two latter power companies, under the supervision of a permanent Engineering Board created by the Columbia River Treaty. The existence of this structure notwithstanding, a new international diversion would probably require both negotiation at the highest diplomatic level and full provincial participation.

2. Kitimat and Kemano

The Alcan (Aluminum Company of Canada) Kemano project, another British Columbia river development, diverts water out of the Nechako-Fraser drainage, through central B.C. into channels and tunnels to the coastal Kemano generating station. The Kemano project began in 1949 when the B.C. government passed the Industrial Development Act, which gave the Lieutenant-Governor in Council the power to grant Alcan the right to use those waters for its project. In December, 1950, the B.C. government and Alcan entered into a written agreement for the project, and in 1954 the Alcan aluminum smelter began operating. Although not directly involved in the original agreement, the federal government can be involved in day-to-day management of the diversion as a result of its mandate under the Fisheries Act. A recent court case illustrates the strength of the federal government's powers: an application by the federal government under section 20(10) of the Fisheries Act for an injunction that required Alcan to release a certain minimum volume of water into the Nechako River, to protect salmon migrations and spawning grounds, was granted by the B.C. Supreme Court.[1] This injunction specified the actual minimum volumes to be released, and in a subsequent case,[2] Mr. Justice Berger, who granted the initial injunction, stated that "... The Minister [of Fisheries and Oceans] should be able to vary the directions to Alcan regarding the discharge of waters as the need arises". Clearly, while this sort of water resource development is primarily a provincial matter, federal power and legislation give the federal government a permanent voice in the operation of such developments.

3. Prairies

There are a number of dams on the Saskatchewan-Nelson system, described in detail in the 1982 report of the Prairie Provinces Water Board (PPWB, 1982). One of these involves an international diversion. An old irrigation system in Montana takes water out of the St. Mary River into the Milk River; therefore this might be regarded as a diversion from the Saskatchewan-Nelson basin into the Missouri basin. Under Article VI of the Boundary Waters Treaty, the two rivers are treated as one for the purposes of apportionment, and the waters are apportioned equally between the two countries. The apportionment is supervised by the International St. Mary-Milk River Board of Control, created by the I.J.C. in 1921 (Carroll, 1983:202).

In southern Alberta, several dams and canals serve irrigation districts. Irrigation causes a minor, indirect inter-basin water transfer when water withdrawn from the Bow River basin is transferred to the Oldman River or Red Deer River basin as run-off from the irrigated fields (Canada West Foundation, 1982:73). In 1977, 1978 and 1979, the volume of water transferred out of the Bow basin averaged only about 445,000,000 m^3 (about 361,000 acre-feet), with just over 80% of that volume ending up in the Red Deer River basin (Canada West Foundation, 1982:73). Of course, this transfer occurs only during the crop season. The Alberta government, primarily through Alberta Agriculture and Alberta Environment, is involved in these irrigation developments in Alberta along with the Irrigation Districts and the individual farmers. Joint federal-provincial action led to the construction of the Qu'Appelle Diversion in Saskatchewan, which diverted water from the South Saskatchewan River to the Qu'Appelle River, primarily to improve municipal water supply to Regina and Moose Jaw (Canada West Foundation, 1982:192).

On the prairies at present, water apportionment is a more important issue than diversions. There are two categories of apportionment -- interprovincial and international -- and administrative arrangements exist for each. (In Chapter II we suggested that international reapportionment can be viewed as a form of water export). In 1969, the three prairie provinces and the federal government signed the Prairie Provinces Master Agreement on Apportionment. The agreement allows Alberta and Saskatchewan to use 50 percent of the water flowing through or rising within boundaries of each province, thus ensuring that Manitoba receives a share of those flows. The agreement is administered by the Prairie Provinces Water Board, a joint federal-provincial body. The Board makes recommendations on questions from or disputes between any of the four parties. If the Board's recommendations do not satisfy

the parties, the Master Agreement makes the Exchequer Court of Canada the deciding body. We have no information to suggest that this machinery has ever been severely tested.

Along the Saskatchewan-U.S. border there are two examples of international apportionment, both the subject of some international tension. A large lignite coal-burning power station, owned by Saskatchewan Power Corporation, stands just north of the Montana border on the Poplar River, which flows south into the Missouri River system. The power plant's construction has led to disputes not only about its effects on water and air quality in Montana, but also about water apportionment, as Saskatchewan's plans called for using water from the Poplar's three forks for cooling. As we have seen, under the Boundary Waters Treaty, upstream diversions may be made without U.S. or I.J.C. approval -- indeed, without notification. (However, Canadian federal approval is needed under the 1955 International Rivers Improvement Act.) The I.J.C. was called on to make a definitive apportionment of Poplar River flows. When the three forks of the Poplar are considered as a whole, the Commission's decision could be said to have divided the flows into roughly equal national shares. This allotment, not called for by the Treaty nor by the spirit of the Helsinki rules in international law (which suggests that water be apportioned in accordance with benefits), is in the emerging "tradition" of equal apportionment. The I.J.C.'s earlier Pembina River recommendations, which had used water apportionment as the foundation for a joint irrigation scheme straddling the border, were never implemented. But its water-sharing decision was historically significant for such later cases as Poplar River. An I.J.C. board watches the Poplar for the Commission.

The second example is slightly further east, where the Souris River in the Assiniboine system winds out of Saskatchewan through North Dakota into Manitoba. Flows, once the occasion of vigorous transborder friction, are small. Today, under I.J.C. rulings, half the natural flow must pass into the United States while the rest may be used upstream. When the Souris River meanders back into Manitoba, a minimum flow must be guaranteed. But neither North Dakota nor Manitoba have any substantial works depending on this river's levels and flows: the extensive Lake Darling near Minot, North Dakota, is a wildlife refuge; floods have recurred in recent years. An I.J.C. control board makes recommendations concerning year-to-year decisions within the previous I.J.C. rulings.

3. Great Lakes

The waters of the Niagara River, the St. Mary's River at Sault Ste. Marie, and the St. Lawrence River run through hydro-electric stations, have been apportioned by various agreements and treaties. Under these agreements the hydro entities themselves keep track of the flows they are using and report to a "control board" under the I.J.C. The I.J.C. thus ensures that the flows are apportioned in accordance with the original agreements. It has also been assigned a responsibility to various interests to see that navigational channels have enough depth, and that the levels of the Great Lakes themselves do not rise to an extent that will damage shore properties. These deep-seated arrangements have given the two countries unparalleled day-to-day experience in international freshwater apportionment and management.

5. Chicago Diversion

As mentioned in Chapter III, the original Chicago Diversion was constructed in 1848. By 1929, the average flow annually was as much as 10,000 cfs. Wisconsin and other lake states disputed in the courts the right of Illinois to divert such a large volume. Between 1925 and 1980 a series of decisions and orders by the U.S. Supreme Court forced Illinois to reduce the diversion, which is now of the order of only 3,200 cfs.

The chief reason for judgement of the Supreme Court has been the injury suffered by other lake states, chiefly with respect to navigation, caused by the lowering of lake levels by the diversions. The injury suffered by Canada from the same cause seems not to have been a reason for judgement. In vetoing a bill by which Congress would have authorised increased diversions at Chicago the President (Eisenhower) did say that it seemed to him "that the additional diversion is not of such national importance as to justify action without reference to the views of Canada" (U.S. Congress, 1968:644). Apart from remarks such as this, the Chicago-Michigan diversions have been treated chiefly as a domestic issue between American states.

In 1977 the two national governments referred to the I.J.C. the question of the effect on the levels and flows of the Great Lakes basin of the existing diversion at Chicago (and of other diversions around the lakes). In September, 1981, a report was submitted to the I.J.C. by its technical board; so far, the I.J.C. itself has not reported to the governments. Truly this is a mammoth and intricate question, one that dwarfs the I.J.C.'s

previous complex levels-and-flows management references. Although the Board's report is difficult to understand, and seems somewhat evasive, two points stand out. First, only a small fraction of the present 3,200 cfs flow through the Chicago diversion can be reduced further if the port of Chicago and the navigation canal are to be kept in business. Second, any further reduction of the diversion would have only a small effect on the level of Lake Michigan and the other Great Lakes (I.J.C., 1981, pp. 7-1 to 9-8).

If these are also to be the I.J.C. findings, then the Chicago Diversion has importance for water exports only if present limitations and constraints are changed. For example, the U.S. Congress might decide to override the objections of the lake states, and to increase flows down the Mississippi watershed, and thus release flows upstream in the Missouri system for irrigation and water supply. In this way the Chicago Diversion could not only carry present Great Lakes boundary waters to U.S. consumers, but also other waters diverted into them from the James Bay or Ottawa River systems. Such U.S. action would require Canadian participation in determining a new regime of Great Lakes boundary water levels and flows (and new I.J.C. controls). Furthermore, it would be of little practical importance unless not only Canada but also Ontario and Quebec actively entered into the roles of water exporters.

5. Summary

The foregoing discussion, although by no means all-inclusive, demonstrates that Canada has had considerable experience dealing with a wide array of inter-governmental water quality and quantity issues. For water exports, nine key points should be stressed:

1. Transfers in Canada have required provincial participation.
2. However, the existing federal legislation on various points is not to be ignored, notably the Boundary Waters Treaty, the International Rivers Improvement Act and various ad hoc statutes.
3. The Harmon doctrine allows Canada and the United States to cut the flows of streams entering the other country.
4. This has not been done on any stream, though it did come up in connection with the Poplar water division.
5. Rather, the rule on prairie water divisions has been to cleave closely to a 50/50 split.
6. These have involved private parties, provincial governments, the federal government, and the I.J.C.

7. The most important diversions into the Great Lakes system, the Long Lac-Ogoki diversions into Lake Superior, involved the Ontario Government, Ontario Hydro (as consumer) and the federal government.
8. The most important diversion out of the Great Lakes system, at Chicago, is presently restrained by (a) a domestic decision on a U.S. interstate legal action and (b) presidential deference to ongoing agreements and cooperation with Canada.
9. The Chicago Diversion could become an important route for Canadian water exports. If so, its use would require cooperation and consent from a long list of authorities and governments on both sides of the border.

B. Administration/Procedure

Water exports are an emotional subject. Government has dealt with this tricky matter by running for safety: by making declarations that water is not for sale. So far this has been a safe strategy because there are few influential and articulate interests in favour of water exports. Now however, anticipating that activists in the U.S. or Canada may soon make more concrete proposals, government must have policies and procedures ready to meet the pressures.

Compared to United States governments which have been dealing with vigorous proponents of ever-increasing water transfer projects for at least a century, our Canadian governments' warehouse of ideas is nearly bare. This is serious because our laws, constitution, climate and geography differ so drastically from those in the United States that we do not know whether we can safely transfer practice, traditions, or procedures. Nor are our professional or academic resources yet prepared with the familiarity and expertise necessary. Our water supply hydro-power engineering professionals have contributed much of the knowledge and experience behind the mechanisms and procedures reviewed in Part A of this chapter. But what mechanisms and procedures are to define the main water export questions and frame the main decisions? In what sort of administrative, fact-finding, evaluative, legal and monitoring set-up are our experts to work?

In this section we explore we explore these questions by identifying necessary qualities or characteristics of the mechanism or complex of agencies.

1. Economic. This first characteristic recommended follows from everything said so far in this study. The policy message suggested was that each water export proposal should be looked at on its

economic merits. Further, it was asserted this could best be done by formally evaluating its benefits and costs so that such aims as regional growth, environmental protection and ecological continuity were given weight from the outset. In short, around the economic evaluation of each water export proposal should be constructed the whole procedure of decision making.

2. Provincial and local point of view. A second characteristic recommended is that the project appraisal procedure should from the outset adopt the point of view of those most affected. In the case of water export proposals, this means that federal, provincial and local participation in the evaluation and decision-making procedures should be built in. To make this clear it should be emphasised that our survey of the legal, constitutional and regional realities in Canada have not indicated that it is safe to depend on either a "national" or on a narrowly localised point of view. The provinces have an overwhelmingly strong proprietorial interest in water resources, and they have as well almost unchallengeable legislative powers to transfer waters among their own regions, cities and industries, subject only to their responsibilities to neighbouring provinces.

However, because personal interests in water use are customarily regarded almost as private rights (whatever provincial law may say) the provincial governments are not in fact free to meddle with existing river-basin flows without a strong political mandate arising from well-understood, if implicit, regional consent. Consequently local and regional districts and councils administering waters affected by exports will eventually be involved and should, for economy of information dissemination and information gathering, be involved at from the beginning. Obviously however, the provinces and their components are not competent alone to handle water exports. Their approval, if it were forthcoming, might still injure those goals and interests trusted to the federal government, running from parks, fisheries and boundary waters to high policies concerning international relations and the economy.

Nevertheless, it is recommended here that so far as possible the agencies and mechanisms involved should have a predominantly provincial and local viewpoint. In the jargon of foreign affairs, the procedures and decisions would have so far as feasible a "transnational" (group to group) rather than an "international" (External Affairs to State Department) orientation. This recommendation cannot be pushed to an extreme limit, for Ottawa's experience with and responsibility for national identity and sovereignty in the face of United States determination, and its explicit constitutional responsibilities, demand that no thought be

given to its exclusion. But the public must be relieved of the suspicion that Ottawa favours (or detests) projects for which the main benefits and costs would be incurred regionally, not nationally. Thus water export evaluation must have a predominantly provincial and regional point of view, embedded in a procedure in which all levels of government are adequately represented.

To undertake a benefit-cost analysis from several viewpoints is not impossible. But usually overly-firm rules or principles must be adopted in advance, and these can militate against decisions that might benefit all parties (see Jones, et al. 1980). Analysis of these problems suggests that Canada's goals with respect to water export proposals would be best served if the first and strongest voice was at the provincial level.

3. Individual compensation. A third characteristic recommended is that the policy should make full provision for individual compensation. This extends the previous "viewpoint" characteristic to the level of the individual water user: Canadians whose property is acquired or damaged in the carrying out of a water export project, or whose welfare is reduced. Existing policy on megaprojects is ambivalent about this, for government's role as promoter has often conflicted with its role as protector of property and individual rights. That this should be remedied is indicated by what every researcher soon learns: Great water projects of the past are perhaps best remembered today by the manner in which they dealt with those whose lands were flooded. The displacement of Iroquois villagers on the St. Lawrence and of Arrow Lake riparians under the Columbia treaty; the flooding of Tweedsmuir Park without replacement; and the buying-out of native rights for the James Bay project -- all are recalled when the engineering, strikes and construction booms are forgotten. Most of these arrangements involved circumvention of normal provincial expropriation procedures, which in some provinces have anyway yet to be modernized. Since water exports can hardly be disguised as anything but money-making schemes for the governments, it is obviously important that those who are forced to move are generally compensated. The same is true of those who lose jobs or markets.

It is particularly important that the procedure give due weight to the compensation of those who hold provincial water rights. These are legally licences or permits and, as outlined in Chapter II, are not evidence of users' full water "ownership". Today's provincial laws make private compensation for transfer of these rights difficult, and even seem to contemplate that holders could be deprived of their water at governmental discretion. At

the very least, such rights should be turned over to a water export project only with compensation, as if they were rights to land.

It is unlikely that this discretion will be forgotten, since in every previous railway, canal, pipeline and transmission project the acquisition of private rights has been the most conspicuous, politics-ridden aspect of the institutional arrangements. It would be pleasant if now, before a proposal is before us, the land and water expropriation and compensation provision procedures could be settled so that other aspects of the proposal would get more attention, for compulsory land acquisition is inevitably an individual, distasteful, strategic business of appraisal and hard bargaining business mixed with sporadic generosity.

4. Project design optimization.

This characteristic is related to the first: that the machinery should make provision for prior optimisation of the proposal, and subsequent learning by doing. Any benefit-cost procedure, if properly carried out, should be able to detect and develop proposals that will make everyone better off, that will be a part of economic growth. This aspect of an acceptable project is not important if it is a small project. But if it is large, it is worth investing in a dynamic process of evaluation that starts with the development of the proposal before final selection and approval and continues with its subsequent shaping by management, monitoring and modification.

In the case of water export proposals this means that an agency must not waste time on an ill-thought-out project, but must be free and able to substitute one or more superior variants. It should look not just for positive net benefits but maximum net benefits. Furthermore, it should as far as possible be able to recommend that projects be approved in small or "attenuated" versions, capable of doubling or filling-out later as information accrues.[3] Since the development of the projects and the decisions about this development may thus be stretched out, there is much to be said for a two-stage procedure, one concerned with the general acceptability and suitability of the project as a concept, and the second concerned with the construction timetable, project refinement, impact modification, re-routing, mitigation, compensation and so forth.

An optimized project design will have elements of flexibility to cope with the uncertainty of future water supplies and demands n both countries, particularly to reduce the burden of an irreversible commitment to supply water. This aspect of optimum project design is discussed under item 8 below.

5. Information acquisition and learning. This characteristic reminds us that the procedures should provide for the informing of both the formal decision-makers and of all who are concerned. As Thompson and co-authors (1981) point out, there are many kinds of combinations of:

(a) initial information collected and provided by the proposal's promoter;

(b) information about the attitudes and actions of all levels of government and their departments. Many effects of the project will stem from how local, provincial and national health, school, social, agriculture, water, housing, transportation, fisheries, and environmental agencies will behave as part of their bureaucratic mandate -- if the project proceeds. Obviously such agencies must be kept informed. Better, they should contribute information about the effects of their own actions.

(c) expert evaluation of documentation;

(d) hearings on (a), (b) and (c) : these can be judicial and adversarial; informal and repetitive; consultative of neutral experts; and so on.

The best sequence of these, and the role of hearings in the sequence depends in part on the amount of responsibility the authorities are willing to take for the final decision. The procedure can be used to educate the public and mobilise opinion as well as to obtain specific data for its own purposes. The point here is that how information is disseminated and acquired is a main characteristic of a water-export evaluation procedure.

6. Prior and subsequent information. This characteristic has to do with the timing of information, and the role of monitoring. Any procedure imposes heavy costs of documentation, data, hearings and bargaining and may deter applicants from advancing flexible and unfinished proposals. The requirement for initial information cannot however, be waived. Information is necessary under any policy or institutional set-up, so it is efficient that information costs be charged against the claimed benefits of a project by being being added to the other private and social costs mentioned in Chapter V.

Note that the best arrangement would seem to be for the promoter to start the informational wheels turning. If the provincial governments wish to sell water they can anticipate demand by putting together a prospectus on exportable flows. But their doing so is not called for here. Nor do we see an extended "prior information" role for the federal government.

What information should the applicants furnish? Any who have observed environmental impact hearings in recent years will agree that some appraisal systems do seem to call for, and produce, excessive amounts of data, often with little notion of how they are to be used (Olynyk, 1984). Not surprisingly, such broad demands are often met by the provision of an encyclopaedic bounty of facts, poorly classified and analysed and a stubborn resolution to provide no more information or to discuss how different project designs might have different environmental or social consequences.

Thompson and co-authors (1981) suggest that this relevance problem can be partly dealt with by a two-stage procedure. The promoter would provide enough information at the first stage to support the general justification of the proposal, leaving to a second stage (after project approval-in-general) a more educated request for that specific information that would be required for consent to the project's various effects. At stage two current immediate information costs can be traded off against future monitoring costs, envisaging later optimising of both the design and the operation of the original version of the project.

7. Centralisation. This characteristic has to do with the extent of "centralisation" of the decision-making procedure. How shall the various kinds of agreement to and approval of a large-scale water export proposal be co-ordinated?

Various administrative devices can be imagined here. At one extreme there is a "one-window" approach. A single designated agency may act as the applicant's agent in ascertaining the requirements of all parties under their various statutes and policies. It may even deal with other levels of government, and with U.S. agencies.

However simplifying this may appear, it is doubtful if anyone can name one department or bureau that can represent all governments' in such a complex business as water export. The provisions of some legislation call for the exercise of discretion on the part of a minister: this cannot always be delegated to another body. The problem is even more serious when, as here, the departments are at different levels of government. Furthermore, bureaus' traditions and jealousies may prevent centralisation. Neither the NEB nor the Northern Pipeline Agency has successfully replaced all other bodies.

Nevertheless, quite apart from the time and costs of compliance with dozens of departments, there is one very good

reason for some form of centralisation. It can be stated in two ways. Centralisation can be sought as a means of avoiding the "tyranny of small decisions". By this is meant that faulty arrangement whereby, when every administrative hurdle has been leapt and every environmental and social safeguard has been met, there is still the feeling that the main theme of the object has not been fully examined, or that no decision-maker has been made to glimpse the proposal in all its broad economic, environmental, ethical, political and social dimensions. Alternatively, centralisation can be sought as a means of "internalising" the final decisions about the proposal so that instead of requiring a flat approval on every aspect, the governments have been able to trade off less important for more crucial characteristics.

8. Flexibility. This characteristic is essential in every procedure governing projects that endure for many years. The size or route of the water transfers, the water quality, or the mere fact of export may become more or less onerous in the future. The payment for water may seem excessive (to the American importer) or deficient. The need here is for both parties to be able to enter into discussions to alter the arrangement, and eventually to impose their changed preferences. Presumably an agreement that meets this criterion will call for them to give notice, in months or years; and to compensate the other party.

Earlier chapters have shown that this problem has been encountered before in connection with hydroelectricity exports. Canadians will probably be most concerned about keeping powers to revoke or reverse a water export agreement. Both a "real" and a financial instrument exist to ease this problem. The real solution is to make sure that Canadian water reaches U.S. users competitively (in a canal network) with water from other sources. Then the withdrawal of Canadian exports will cause only a marginal loss to those using it. The financial solution is to sell or rent the water flows on a non-firm or interruptible basis. While both these solutions reduce the amount that American users are likely willingly to pay for Canadian water, both give Canadian regions security in the face of uncertainty about future climatic and economic states of the world. Flexibility is a characteristic that can be built into any procedure. Too much of it, however, makes both countries (Canada especially) vulnerable to unpredictable political changes in the other's domestic policies regarding its water-providing and water-consuming regions.

C. Conclusions: A Water Export Council

The eight qualities or characteristics of the recommended economic procedure ought to be embodied in machinery. Can we find an existing agency or bureau that can perform the functions implied in these requirements? "One window" procedures installed in the various provinces have given us some experience of agencies that are charged with decisions and with administration of projects that impinge on the mandates of more than one government branch. These systems are still being perfected. Their existence does suggest that it is possible for a government concerned with a water export decision to be represented by a small number of officers, qualified to speak and act in pursuit of all those goals entrusted to separate agencies. Whatever it is called, an agency to coordinate the talents and missions of these officers should make it possible to see the project as a whole, escape the tyranny of segmented small decisions, and adhere to an orderly benefit-cost evaluation, optimisation and monitoring of a water export proposal.

The problem is that more than one level of government is involved. In spite of the primacy of the provinces today, it is unlikely that we can find a single provincial bureau or agency that can act on behalf of its own government and the national government as well. Although the problem of machinery is a federalistic rather than an international one, the Canadian experience with the International Joint Commission may suggest how the governments may at minimal transactions costs work together on the implementation of the necessary procedure.

The required characteristics reviewed in the previous section might be assigned to a high-level council composed of "sections" reviewed in the previous section respectively appointed by each government involved. The council, like the I.J.C., would have a small expert secretariat. Like the I.J.C., it would be able to appoint subsidiary expert boards to report to it on specific questions. These boards' members would normally be seconded from federal and provincial public services. The governments at both levels could refer to this council, at an early stage, water-export proposals made to any of them. The council could then proceed to obtain information, hold hearings, receive reports, analyse the proposals, optimise and refine them and report for or against them to the parent sponsoring governments. Should its report be unfavourable, non-partisan procedure will have helped to alert and educate citizens and governments to the value of water to the Canadian environment and for potential future users.

Should its report be favourable and should the governments accept the report, the council could then be entrusted as a consultant to Canadian diplomats and provincial officers officially charged with negotiating the best possible agreement. It is important that the events and drama of negotiation be guided away from excessive salesmanship or excessive caution. The council should be able to offer a sober understanding of what conditions are essential for each water export project.

There are several arguments favouring continuing council involvement after the negotiations. First, the council will by that time be well informed, it can provide continuity, and it will know well the opportunities and reservations perceived by all levels of government. Second, the Columbia Treaty negotiations showed the possible impotence of federal international negotiating teams that failed to carry an explicit mandate from the province involved. Third, flexibility requires that the agreement contain safeguards that will probably be more keenly desired by the provinces than by Ottawa. Finally, the commission, more than the federal government, can understand the value of "learning by doing": monitoring effects of large-scale projects that may lead to recommended changes, including either possible expansion or complete discontinuation and abandonment of the project. The I.J.C. provides a pattern in connection with monitoring and the enforcement that may go with it.

The council would therefore be involved at a third (operation and monitoring) stage. Like the International Columbia Engineering Board it would be responsible to the Canadian governments for ensuring that the international agreement was adhered to, reasonably. Secondly, like the Great Lakes Water Quality Board, it would carry out research, monitor ongoing environmental and social impacts, and recommend changes that carry out the "flexibility" characteristic discussed in the previous section.

Further detail would be inappropriate here. This study has emphasised the need for a "policy" of examining water export proposals on their merits, coupled with a procedure. Most of the chapter has been concerned with emphasising eight rather abstract characteristics that the procedure should possess, given that its main purpose is to conduct an examination of particular schemes. This section has suggested that, in the absence of a single government department currently available to harmonise this examination procedure, a new council should be set up, even before any project is proposed, to conduct the examination, advise the governments in any subsequent international negotiations, and represent them to check on continuing monitoring and enforcement.

Endnotes to Chapter VI

1. Attorney-General v. The Aluminum Company of Canada. Unreported judgement, Aug. 6, 1980, Supreme Court of British Columbia.

2. A.G. of Canada v. the Aluminum Company of Canada (2). Unreported judgement, Aug. 11, 1980, Mr. Justice Berger (in Chambers).

3. The building of canals and dams generate economies of scale. It is the loss of these economies that is one of the main costs of "starting small". The arguments for and the extra costs of this "learning by doing" have been investigated by H.F. Campbell and Anthony Scott in such articles as Campbell and Scott (1979). The idea is carried in other directions by A.R. Thompson and various co-authors in Westwater Research Institute publications (see Thompson, Bankes and Souto-Maior, 1981) and by C.S. Holling in a continuing campaign for "adaptive" environmental assessment theory and procedures.

CHAPTER VII. CONCLUSIONS AND RECOMMENDATIONS

This study has proposed that water export projects be separately assessed by a government review process, using economic criteria for determining desirability. The particular approach recommended is the use of benefit-cost analysis on a project-by-project basis. Benefit-cost analysis provides a comprehensive framework, giving due weight to the financial, environmental and social affects of water export projects. In Chapter V of this study we demonstrate how this economic approach can be applied to a water export project, though our information base is incomplete and the economic values uncertain.

For many people, one of the most important issues is who controls water exports. The water within their boundaries belongs to the provinces, to the extent that the law recognizes ownership of such "fugitive" resources. This proprietary role gives them the lead in managing water resources -- including water exports. However, the division of other powers between the federal and provincial levels of government under the Constitution Act gives each level a virtual veto over water exports.

The obvious consequence of this is that both levels of government must participate in applying the proposed economic analysis to Canadian export projects. The provincial governments, in addition to their proprietorship over water, have responsibilities to look after most affairs in the exporting region and along the diversion route. At the same time, the federal government must be involved to ensure that national impacts -- including, for example, the cumulative effects of a number of export diversions from different

export diversions from different provinces -- and international impacts -- such as the potential political problems of halting exports should the need arise -- are considered. In addition, the federal government has some local responsibilities such as those for fishing, for agriculture, and for the north. The study provides a brief description of one possible arrangement that could coordinate federal and provincial powers in a water export council and that would reflect the eight "necessary qualities" outlined in Chapter VI.

Water exports are a contentious issue in Canada. Many Canadians rebel at the thought of water as an economic commodity, especially in interregional or international affairs. Others view it as an exportable resource like any other. The policy proposed in this study for water exports would be flexible enough to allow full scope for these and other divergent viewpoints. The proposed procedure for reviewing water export projects would provide a consistent and comprehensive framework for evaluating the benefits and costs for Canada, but it does not over-ride whatever values people place on their water resources.

For those who are reluctant ever to sell water the procedure provides a niche for their objections and also lets them express in terms of foregone dollars the intensity of their feelings. For those who are neutral or favourable, the procedure saves them from endorsing socially-profitless or inferior projects. For those who are concerned about our water resources as national wealth in itself, the procedure gives promise of preventing ignorant and careless water allocations.

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